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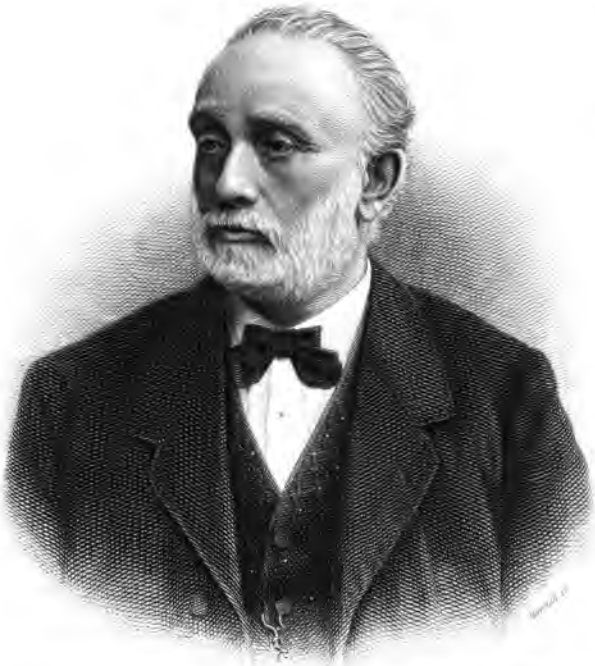

Prof. Dr. Büchner.

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FORCE AND MATTER

OR

PRINCIPLES OF THE NATURAL ORDER OF THE UNIVERSE.

WITH A SYSTEM OF MORALITY BASED THEREON.

A POPULAR EXPOSITION

BY

PROF. LUDWIG BÜCHNER, M. D.,
FORMERLY MEDICAL LECTURER AT THE UNIVERSITY OF TÜBINGEN.

NEWLY TRANSLATED
FROM THE FIFTEENTH GERMAN EDITION
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FOURTH ENGLISH EDITION.

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LEIPZIG,
THEODOR THOMAS.
1884.

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To the dialectician the world is an idea, to the *bel esprit* a picture, to the enthusiast a dream, to the scientist alone it is a truth.

Orges.

The criterion of a true philosopher is that he is not a professor of philosophy. The plainest truths are those precisely upon which man hits last of all.

Ludwig Feuerbach.

Experience and observation must be our sole guides; we meet with them in the case of physicians who have been philosophers, but not in the case of philosophers who have not been physicians.

Lamettrie.

We must have facts and a positive philosophy, based upon nature and reason.

H. Tuttle.

And if the inscription on the ancient pyramid of Saïs says, "I am all that is, that was, and that will be; no mortal man has yet raised my veil," it might be replied thereto: "Modern science has removed the veil and has discovered that Force and Matter were, are and will be."

F. J. Pisko.

The number of errors is unlimited, truth alone is but one.

Ph. Spiller.

It nettles men to find that truth should be so simple.

Goethe.

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FRIEDRICH CARL CHRISTIAN LUDWIG BÜCHNER,

AUTHOR OF "FORCE AND MATTER,"

was born at Darmstadt on March 29, 1824. He is the third son of the late Dr. Ernst Büchner, some time Physician to the Grand Duke and afterwards Privy Councillor of Health, and the younger brother of *Georg Büchner,* author of the famous tragedy "Danton's Tod," who died in his twenty-third year, a political refugee and *privatdocent,* in the university of Zürich.*) Young Büchner was educated in the college of his native town, and on leaving it on the April 5th, 1842, at the age of 18, he had his qualification for university studies endorsed as follows: "The holder of this has distinguished himself by profound literary, philosophical and poetical studies, and has shewn remarkable ability in all his compositions." He then proceeded to the Technical Institute of Darmstadt, where he studied natural philosophy, chemistry, botany and mineralogy, and twelve months later, in the spring

*) Georg Büchner's "Nachgelassene Schriften" and Biography appeared in 1850, published by J. D. Sauerländer at Frankfort on the Maine, and were re-issued in 1879 by *K. E. Franzos* under the title: "Georg Büchner's sämmtliche Werke und handschriftlicher Nachlass. Erste kritische Gesammtausgabe. Mit Portrait des Dichters und Ansicht des Züricher Grabsteins." Frankfort on the Maine, J. D. Sauerländer.

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of 1843, he went on to the university of Giessen, where he devoted himself to general philosophical studies. At his father's desire he abandoned this branch a year after for the special study of medicine. This was the time when the new departure given to natural science and medicine by Liebig and Bischoff, which took its stand on chemistry and microscopy, began to supplant the older school of natural philosophy represented by Wilbrand, Ritgen, and others. Side by side with his medical studies, Büchner continued his course of philosophy and æsthetics under Hillebrand, Adrian, Carrière and Krönlein. As an undergraduate he took a lively share in the movement towards a reformation that was just then springing up among the German students. He was one of the founders and leaders of the progressive association *Allemannia,* that had been established at Giessen and soon mustered several hundred strong. After Büchner had spent also six months in attending a course of French lectures at Strasburg, he passed his medical examination at Giessen in the spring of 1848 with honours (*magna cum laude*). The summer of that stormy year was divided between the composition of his inaugural dissertation, "Beiträge zur Hall'schen Lehre von einem excitomorischen Nervensystem" (Giessen 1848), the preparation for his public "thesis," and the share he took in the political movements of that agitated period. He wrote reports of the "Vorparlament" of Frankfort on the Maine for a political paper published at Giessen, and took an active part in the numerous popular meetings that were then held in and around Giessen, as well as in the establishment of the volunteer corps.

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In the autumn of 1848, after his dissertation had been printed and his disputation had come off, in which, among other theorems, he advocated the proposition that "a personal soul is inconceivable without a material substratum," Büchner left the university of Giessen and went back to his native town as *doctor promotus*. Here, in conjunction with his former fellow-students and political confederates, and supported by the *Neue deutsche Zeitung*, a paper published at the time at Darmstadt under the editorship of Dr. Otto Lüning, he continued his labours for political freedom on very unsafe ground, until the insurrection in the grand-duchy of Baden, and along with it all political agitation, had been put an end to and a very uncomfortable period began for those who had committed themselves in the preceding twelve months. Büchner did not suffer the same inconvenience as some of his friends and fellow-workers, partly owing to his position as a medical man, and partly because he undertook soon after the events referred to, a journey to Würzburg and Vienna with a view to his professional improvement. Prior to this, however, he had published the "Posthumous Works" of his brother Georg, and had written a biographical notice of the author as an introduction. At that time, Virchow was a professor in the university of Würzburg, and Büchner was greatly attracted by the rising fame of that great scientist; the subsequent tendency of his thoughts was in a great measure shaped by Virchow. After returning from Vienna Büchner devoted himself in his native town partly to medical practice and partly — at his father's wish and instigation — to the composition of works and opinions on forensic

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medicine, most of which were published in the "*Vereinte deutsche Zeitschrift für die Staats-Arzneikunde,*" edited by Schneider, Schürmayer and others (Freiburg im Breisgau.) These labours were so favorably received by the profession that in 1855 the Union of Baden Physicians for the promotion of Forensic Medicine elected their author a corresponding and honorary member of their body.

Meanwhile Büchner had been appointed assistant physician in the Medical Hospital of Tübingen, which was at the time superintended by Professor *Rapp,* and had also settled down as *privatdocent* in the university of that place. During the three years he spent at Tübingen, he delivered, apart from his duties as hospital physician, well-attended and much applauded lectures on syphilis, the pharmacopœa, physiological diagnosis, the medical encyclopædia, and forensic medicine. The last-named subject attracted Büchner more particularly on account of its humane tendency. In this department he was chiefly engaged in endeavouring to turn the new discoveries of physiology and pathological anatomy to practical use. His opening lecture as a *privatdocent* on "The night-life of the soul in relation to Forensic Medicine," was subsequently published in the aforenamed Baden journal. During this period he also wrote numerous medical essays for the *Deutsche Klinik,* for Virchow's *Archiv,* for the Prague *Vierteljahrsschrift* and Vierordt's *Archiv,* besides some popular scientific papers which appeared in periodicals devoted to general instruction. In the year 1854 the meeting of German naturalists came off at Tübingen, which was held by common consent to be one of the best and liveliest of all the congresses

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of this kind. Büchner reported on this meeting for the *Staatsanzeiger für Würtemberg* and for the Augsburg *Allgemeine Zeitung*. These labours, together with the reading of Moleschott's *Kreislauf des Lebens* inspired him with the idea of writing *Kraft und Stoff, empirisch-naturphilosophische Studien*, a book that has acquired a great deal of note since, and in which he made a bold attempt at transforming the then prevailing theory of the world which was based on theological philosophy, and adapting it to the requirements of modern science. The tendency and method of this exposition were such that, when the work was first published in 1855 by the firm of Meidinger of Frankfort on the Maine, it was so favorably received that a new edition became necessary within a very few weeks. For the author himself this involved a good deal of personal inconvenience, for he was obliged to resign his chair at Tübingen and return to his native place, where he resumed his former labours as a practical physician. Meanwhile the book passed rapidly through a number of editions; it created quite a stir in the press, and became the subject of much hostile criticism and of many polemical writings, entangling its author in a vortex of literary controversy. Büchner met all the attacks levelled at him, partly in the prefaces which preceded the various editions of *Kraft und Stoff* from the third to the tenth, and partly by articles in periodicals, in which he discussed numerous other matters connected with the subject of the book.

In the year 1856 a weekly review, called *Jahrhundert*, was founded at Hamburg, in which Büchner published among others the following essays: "History

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of the Earth"; "Light and Life"; "The Idea of God and its Signifiance in the Present Age"; "The Positivists"; "No more Speculative Philosophy"; "The Poetry of Force and Matter"; "The Immortality of Force"; "Professor Schleiden and the Theologians"; "Earth and Eternity." In the "Anregungen für Kunst, Leben und Wissenschaft," published at Leipzig, appeared the following essays: "The Cycle of Life"; "Earth and Eternity"; "From and on Schopenhauer"; Contributions to the Natural Theory of Man"; "Materialism, Idealism and Realism"; "On the Psychical Life of the New-born"; "On the History of Creation and the Destiny of Man"; "Body and Soul." In the *Stimmen der Zeit* appeared: "Professor Agassiz and the Materialists"; "Philosophy"; "The Philosophy of the Period"; "The Progressive Development of the 'Freie Deutsche Hochstift' of Frankfort on the Maine"; "Volition and Natural Law"; "A New Theory of Creation." Then we find in the "*Gartenlaube,*" the popular essays; "The Antiquity of the Human Race"; "The Battlefield of Nature, or the Struggle for Existence; "The Organic Scale, or the Evolution of Life." In addition to these, Büchner had to attend to a vast correspondence resulting from his works, which brought to him letters from all quarters of the globe, and oftentimes contained the most curious requests. In the year 1857, Büchner published "Nature and Spirit: Conversations of Two Friends on Materialism and on the Questions of the Concrete Philosophy of the Present age." In this work he endeavoured to define the conflicting views of the two parties that stand opposite one another in the materialistic controversy, and to fix, by a mutual interchange of opinions, the line

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of demarcation to which the human intellect, guided by pure scientific principles, may progress in our days. However, the form of dialogue in which this book was written, did not seem to meet with popular approval; and the disappointed author, having reconsidered his intention of working out the subject on the same lines, discontinued the publication of the book, of which only the first volume, entitled *Macrocosmos* appeared; the second volume, which was to have dealt with "*Microcosmos*," is not extant. Still, the first volume passed successively through three editions, of which the last was published in 1874 by Th. Thomas, Leipzig.

After the storm had somewhat subsided, successive editions of *Kraft und Stoff* appeared without further prefaces, and Büchner availed himself of his leisure hours for the prosecution of his scientific and studies connected with the medical profession. A work on hæmatine crystals and their place in forensic medicine, written by him in conjunction with Dr. Simon, of Darmstadt, — who in the sequel became professor in Heidelberg University and died in harness — was published in Virchow's *Archiv*. For this paper and some further essays connected with forensic medicine, Büchner was awarded in November, 1860, the silver prize medal for merit, by the Baden Union for the Promotion of Forensic Medicine. Soon after this, the "Freie deutsche Hochstift," of Frankfort on the Maine, at whose meetings he had delivered several lectures, elected him to be one of its masters as well as an honorary member. The lectures alluded to, together with some delivered to the Union of Hessian Physicians at Darmstadt, and some popular scientific essays which had appeared in

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various journals, form the bulk of the materials out of which he framed his work entitled "*Physiologische Bilder*" (Leipzig, 1861). The first volume of this work, of which the second edition appeared in 1872, contains papers on the heart, the blood, heat and life, the cell, air and lungs, and chloroform; whilst the second volume, issued in 1875, contains only two long essays on the brain and on the nerves. The book next published by Büchner embraces a selection of papers that had appeared in the journals already named as well as some that had not previously seen the light of day; it bore the title: "*Aus Natur und Wissenschaft. Studien, Kritiken und Abhandlungen. In allgemein verständlicher Darstellung*" (Leipzig, 1862). Among these treatises, which were intended as an explanation and complement of his work, *Kraft und Stoff*, we meet with the following: — "The Organic Scale, or the Evolution of Life"; "Materialism and Spiritualism"; "Eternity and Development"; "Philosophy and Experience"; "On the Origin of the Soul"; "Physiological Inheritance"; "Instinct and Free-Will."

Meanwhile Büchner had published a translation in a popular form of the latest work of the famous English geologist *Lyell*, under the title: "The Antiquity of the Human Race on the Earth, and the Origin of Species by Variation, with a Description of the Glacial Period in Europe and America. Translated from the English of Sir Charles *Lyell*, with Notes and Additions by the Translator. Intended for the Understanding of All, by Dr. L. Büchner" (Leipzig, Th. Thomas, 1864. Second Edition, 1874). A French translation of the above-named work *Aus Natur und Wissenschaft* appeared under the title: *Nature et Science.*

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Etudes, etc." (Paris 1866. Second edition, 1882); an Italian edition entitled: "*Scienza e Natura,*" at Milan in 1868, and a Russian one at Kieff in 1881; finally, a second and a third enlarged German edition appeared at Leipzig, 1869 and 1874.

In 1868 appeared, "*Die Darwin'sche Theorie in sechs Vorlesungen,*" etc. a work which was so well received by the reading public, that it quickly passed through four editions. The last and much enlarged edition was issued in 1876. A French translation of this book appeared in Paris in 1869; and a *Polish* one at Warsaw in the same year.

In the same year and in the one immediately following, Büchner published in three Parts a work entitled: "Man and his Place in Nature, in the Past. Present and Future; or: Whence do we come? Where are we? Whither do we go?" It was published simultaneously in the *French, English* and *Italian* languages. In 1872 it reached its second German edition, while the third edition of the French translation appeared in 1878, under the title: "*L'homme selon la science*" (Paris, C. Reinwald). In the same year was issued a Dutch translation by R. E. de Haan, published by Blomhert und Timmerman of Nymwegen. The Italian translation has passed through two editions, the second of which was published by Ottino of Milan in February 1883.

This work was followed by: "*Aus dem Geistesleben der Thiere, oder Staaten und Thaten der Kleinen*" (Berlin, A. Hofmann, 1876), which formed the second volume of the third series of books published by the "Allgemeine Verein für deutsche Litteratur"; in this the question of instinct was treated first, and then

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the wonderful life and doings of the intellectually highest articulata (ants, bees, spiders, etc.) were pictured in detail. A year after this, the second edition appeared, and in 1880 the third was published by Th. Thomas, Leipzig. It was translated into French by Letourneau (Paris, 1881), into English by A. Besant (London, 1880), into Dutch by de Haan (Nymwegen), and into Spanish by Ocina de Aparicio (Madrid, 1881).

A counter-part to this book appeared in 1879, as the second volume of the fourth series of the publications of the Association mentioned heretofore. It is entitled: "*Liebe und Liebesleben in der Thierwelt*" (Berlin, A. Hofmann). The second edition was published in 1883 by Th. Thomas of Leipzig. A Dutch translation by de Haan appeared in 1880.

The last important work of Büchner is called "*Licht und Leben. Drei allgemeinverständliche naturwissenschaftliche Vorträge als Beiträge zur Theorie der natürlichen Weltordnung*" (Leipzig, Th. Thomas, 1882). It is composed of lectures delivered in public, and dealing with "The Sun and its Influence on Nature"; "The Cycle of Forces and the Destruction of the World"; and "The Philosophy of Generation." A French translation by *Letourneau* appeared in 1883 under the title: "*Lumière et Vie*" (Reinwald, Paris).

Two minor works of Büchner's have likewise been evolved from lectures; they are: "*Der Gottesbegriff und seine Bedeutung in der Gegenwart*" (First edition 1874, second 1874, both published by Th. Thomas of Leipzig), and "*Die Macht der Vererbung*" (Leipzig, 1882), issued as No. 12 of the series of Darwinian writings published by Günther of Leipzig. The pamphlet on the idea of God has been translated into

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Italian and Hungarian; that on heredity into English and Russian. A third small essay of Büchner's was printed by Stollberg of Gotha two years ago; it is called "*Flugblatt des deutschen Freidenkerbundes*, No. I."

It may be said without exaggeration that Büchner's greatest work, "*Kraft und Stoff*," has made its way all round the world, for it has been translated into no less than thirteen living languages, viz. English, French, Italian, Spanish, Hungarian, Polish, Swedish, Dutch, Greek, Russian, Danish, Armenian, Roumanian. The French translation has up to this day gone through five editions, the English through three, the Italian through three, and the Hungarian through two editions. The sixth edition of the French is in the press, and the present is the fourth English edition. Two German-American editions have been published, one by Steiger of New York, the other by Thomas of Leipzig.

The later editions of *Kraft und Stoff* have been so much enlarged, that the work in its present form may almost be regarded as a new one, although the fundamental idea has remained the same. Yet more light is thrown on the whole question by Büchner's later treatises, issued as independent works, in which the abundant materials gathered up since 1855 have been dealt with in many different ways and in a concise and comprehensive form. The study of these treatises, the continuance of which may be looked for, as well as that of the other writings of our author, is indispensable for all who wish to form an independent idea of this important subject, a subject around which such a cloud of dust has been, and is still being raised. The literature to which *Kraft und Stoff* has given rise either directly or indirectly, is so vast that

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it is scarcely possible to survey it, and of the movement caused thereby in the intellectual world it may well be said that it forms a landmark in the history of Science. It must be reserved to future generations to definitely and impartially judge the merits and demerits of this movement.

In 1860, Büchner married a lady of the name of Thomas, of Frankfort, with whom he has always lived happily and by whom he has had four children, who are now almost grown up. His time is divided between his literary labours and his medical profession. In the stormy years of 1866 and 1870 he was very actively engaged in the care and medical treatment of the sick and wounded, and in recognition of his services he received the cross of the first class of the Hessian Order of Philip the Generous, of the Order of the Crown of Prussia, the order of Francis Joseph of Austria, the cross of the Hessian military order of Health, and the Prussian medal for service in the field. Later on he was made knight of the first class of the Dynastic order of the Ernestine line of the dukes of Saxony and received the title of "Professor" from the Court of Saxe-Coburg-Gotha.

The winter of 1872—73 was spent by Büchner in the United States of America, where he delivered public lectures at the invitation of some German associations, particularly the Gymnastic Societies. These lectures, about a hundred in number, which were delivered in German in thirty two different towns, relate to a number of subjects connected with science in general and the philosophy of Nature in particular, which have since been more fully dealt with in Büchner's subsequent publications. Exceptions to this are an

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essay on the Question, of Woman's Rights, which was prepared at the special request of the American advocates of those rights, and has not yet been published; and one on Materialism, which has only been published in English by A. K. Butts and Co., New York, under the title of "Materialism; its History and Influence on Society."

Büchner's elder sister was *Louise Büchner*, the authoress of: "*Die Frauen und ihr Beruf*" (5h ed. 1883); "*Aus dem Leben. Erzählungen aus Heimath und Fremde*," a collection of tales (1861); "*Das Schloss zu Wimmis*," a romance (1864); "*Clara Dettin*," a narrative poem (1873); "*Deutsche Geschichte von 1815—1870*" (1875), all published by Th. Thomas of Leipzig; besides, "*Frauenherz*," poems (1860; second edition 1864); "*Dichterstimmen*," an Anthology of German, English and French Poems (4th edition, 1873); both published by Gesenius of Halle; also the charming "*Weihnachtsmärchen*," related and dedicated to the two eldest children of her brother Ludwig, and published by Flemming of Glogau (two editions). There are also various smaller writings on female work, of which may be noted, "*Praktische Versuche zur Lösung der Frauenfrage*" (Berlin, Janke, 1870). Louise Büchner died in 1877, in her 56th year, after an active life, devoted chiefly to the education of women and to the improvement of their position in Society. Her posthumous novels and miscellaneous works were published in 1878 in two volumes by J. D. Sauerländer of Frankfort on the Maine; and in the same year those relating to the Woman's question were issued by Gesenius of Halle under the title: "*Die Frau. Hinterlassene Aufsätze, Abhandlungen und Berichte zur*

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Frauenfrage, von Luise Büchner." In the year 1882, the Union of the German "Frauenbildungs- und Erwerbs-Vereine," to the success of which the deceased had largely contributed by her activity, had a magnificent grave-stone put up in her memory in the cemetery of Darmstadt.

Büchner has an elder brother, *Wilhelm Büchner*, who is the owner of a large ultramarine factory at Pfungstadt near Darmstadt, and who has, since 1877, been a member of the Imperial Parliament of Germany for the electoral district of Darmstadt-Grossgerau.

Büchner's younger brother is *Alexander Büchner*, professor of the German language and literature in the University of Caen, in France. He is the author of the "*Geschichte der englischen Poesie*" (Darmstadt, 1855); of the "*Französischen Litteraturbild*" (Frankfort on the Main, 1858); of a translation of Byron's "Childe Harold" (Frankfort, Meidinger); of the novels "*Der Wunderknabe von Bristol*" (Leipzig, 1861) and "*Lord Byron's letzte Liebe*" (Leipzig, 1862); and as of a whole series of literary and historical publications in the French language, intended as vehicles of high-class education.

(This notice is based upon and has been amplified from a biographical sketch which appeared in "*Unsere Zeit, Jahrbuch zum Conversationslexikon*," Brockhaus. 1863, vol. 75, pp. 199 *et seq.*).

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PREFACE TO THE FIRST EDITION.*)

Now what I want, is — facts.

Boz.

The following pages do not claim to form a system, or an aggregate exhaustive treatise. They are scattered thoughts and ideas, collated from the almost boundless province of the empirical study of natural philosophy, yet essentially connected with, and mutually completing, each other. A merciful judgment at the hands of my *confrères* is claimed for them on account of the difficulty to which an individual is necessarily subject in grappling with the innumerable mass of materials spread over the vast fields of natural science. If these pages may venture to claim any merit or characteristic, it is that of representing a determination not to shrink with dismal horror from the simple and unavoidable consequences of an unprejudiced contemplation of nature from the standpoint of empirical philosophy, but to admit of the truth regardless of what may follow. We cannot make things different from what they *are*, and nothing seems to us more preposterous than the attempts of some distinguished naturalists at introducing *orthodoxy* into natural science. We do not pretend to bring forward anything absolutely new or anything that had never

*) Written at Tübingen in the year 1855.

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been heard of before. Similar views and views cognate to ours have been taught in *all* ages, and some of them were laid down by the oldest Greek and Indian philosophers: but their groundwork, which is necessarily empirical, could only be supplied by the progress of natural science in the present century. It is therefore obvious that these views, in their present clearness and consistency, are essentially a trophy of modern times and closely connected with the new and gigantic achievements of empirical science. Indeed, scholastic philosophy, ever riding the high, though from day to day more and more emaciated horse, lays the flattering unction to its soul that these views have long been disposed of, and would fain consign them to the limbo of oblivion, with which object it has labelled them "Materialism," "Sensationalism," "Determinism," and so on; nay, the gentlemen of that school go so far, in their assumed supercilious superiority, as to talk of having given them "the historical quietus." But they themselves are going down day by day in the public estimation, and losing ground in their speculative hollowness before the rapid rise of the empirical sciences, which are making it daily more evident that both the macrocosmic and microcosmic worlds obey, at every stage of their genesis, existence and subsidence, the *mechanical* laws which lie in the very nature of things. Starting from the recognition of the indissoluble relation that exists between force and matter as an indestructible basis, the view of nature resting upon empirical philosophy must result in definitely relegating every form of supernaturalism or idealism from what may be called the hermeneutics of natural facts, and in looking upon these facts as

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wholly independent of the influence of any external power dissociated from matter. There seems to us to be no doubt about the ultimate victory of this realistic philosophy over its antagonists. The strength of its proofs lies in *facts,* and not in unintelligible and meaningless phrases. But in the long run there is no contending against facts; it is useless to "kick against the pricks." It need scarcely be said that our exposition has no connection with the idle fancies of the older school of natural philosophy. These curious attempts at constructing nature by thought instead of by observation, have so completely failed and have brought their advocates into such public discredit, that the very name of "philosopher of nature" is all but generally used at this day as the reverse of a flattering epithet. It is obvious that this reproach can only be levelled at a certain tendency or school, and not at natural philosophy in itself; and there is now an almost general consensus of opinions that natural science must be the basis of every philosophy that lays claim to exactitude. "Nature and experience" is the watchword of the age. The failure of previous attempts of natural philosophers serves as the clearest proof of the fact that the universe is not the realisation of a uniform creative thought, but a complex of things and facts, which we must take for what it is, and not for what we may be pleased to fancy it. "We must accept things as they really are," says *Virchow,* "not as we choose to imagine them." We shall seek to present our views in a generally intelligible form and to base them on known or easily comprehensible facts, and in doing so shall avoid all those philosophical technicalities the use or

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rather abuse of which has justly brought all theoretical. and especially German, philosophy into discredit in the eyes both of the learned and unlearned. *It is part of the very nature of philosophy to be intellectually the joint property of all.* Philosophical disquisitions which cannot be understood by every educated man, are not, in our opinion, worth the printer's ink that is spent on them. What is thought clearly, can be expressed clearly and without circumlocution.*) The philosophical mist which enshrouds the writings of learned men, seems rather intended to hide than to reveal thoughts. The days of learned tall-talk, of philosophical charlatanism, and of "intellectual leger-demain," as *Cotta* strikingly expresses it, are over by this time, or ought to be. May our German philosophy come to recognise that words are not deeds, and that those who wish to be understood ought to speak an intelligible language.

We shall meet with no lack of opponents, and of the bitterest, too. But we shall take no notice of any but those who meet us on the ground of facts and of empiricism. Let the speculative gentry go on fighting one another from standpoints that are their own creation, but let them not run away with the strange notion that they possess the monopoly of philosophic truth. "Speculation," says *Ludwig Feuerbach*, "is philosophy intoxicated. When philosophy shall have become sober again, it will it be to the mind what pure spring-water is to the body."

*) "Men who belong neither to the highest nor to the lowest intellectual spheres," admirably says the famous English physicist *Tyndall*, "often infer want of depth from perfect clearness. They find comfort and support in abstract and learned phraseology."

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PREFACE TO THE FIFTEENTH EDITION.

Comprehensive works, if not simply collated from the works of others, but having grown out of independent efforts, are at this day, as they were heretofore, made to suffer from the fact that the shadow they necessarily cast is seen more clearly than their bright side. They labour under this additional drawback that, in order to accomplish their ends, they have to contend against perennial errors and prejudices which are not only firmly rooted in the minds of men, but command perfect strongholds in the shape of textbooks and University chairs. How readily soever the younger generation may at any time have fallen in with the new teachings, the old school would still remain in existence by the side of the new and would not give way, until all its representatives and advocates had gone the way of the flesh.

Radenhausen.

Eight and twenty years have passed away since the first edition of this book appeared. Many things has changed since then, both in the intellectual and the material worlds. A great political exhaustion has come in the wake of a great political impetus; a general reaction of relaxation, recalcitrance and retrogression has followed a period of intellectual and material progression. This has produced some deleterious influence on the intellectual current originally induced by this book, and it seems as though the distance that separates us from the goal were now

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greater than ever. But who can tell how near the rising wave may be at hand, which shall once more carry us all onward? The ocean of mankind moves according to the same laws as the sea that covers the greater part of the earth's surface. It is in the innermost nature of both to ebb and to flow.

In science also so many things have changed during these eight and twenty years, that it appeared imperative to re-write this book which has had so many readers, and has passed through seventeen German and twenty-two foreign editions. The author has spared no labour in bringing this last edition, as far as it is possible, up to the scientific mark of the present age, and inserting new chapters with a view to connect the various orders of ideas represented in the individual sections with one another. When the book was first written, the empirical materials were not sufficient to form between them a body with clearly marked outlines, and the author was therefore under the necessity of confining himself to publishing them under the unassuming title of "Empirical Studies on Natural Philosophy." Since then, the progress of science has been such that these empirical materials have so accumulated as to make it appear permissible to venture upon a bolder course, and endeavour to build up a more closely connected and more coherent fabric as a system of the natural order of the universe and as a more homogeneous theory of the world. Hence the change of the title of "Studies" into the more assuming and more promising epigraph of "Principles of the Natural Order of the Universe." No doubt, the opponents will have a great many faults to find with this title; they will urge that the empirical

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materials are not nearly sufficient for such an object. and that the gaps still existing in our knowledge are far too great and too numerous to be bridged over in such a manner by theoretical constructions. In their eyes, the whole mass of facts which militate in favour of a natural order of the universe, is of no value whatever, because in some, nay in many, points absolute or relative obscurity still prevails. In this, as Du Prel very pointedly remarks, they resemble a chess-player whose king has only a few pawns left to cover him, but who will not own himself beaten despite the superiority of the men arrayed against him. But in the eyes of all truly competent men the game has long been lost, and the question whether the universe, as we see it, is the result of regularly working forces, having a causal connection with each other and therefore capable of being understood by human reason, or whether it is the work of an automatic, incomprehensible being that admits of no recognition by the reason of man, has long since been decided in favour of the former alternative. Every item of human knowledge, every page of practical experience, every conquest of science, gives but this one answer and makes the old theistic theory of the universe, which originated in the days when mankind was still in its first childhood, appear as a mere fable, engendered by the *rêverie* of past ages. Therefore, the author cannot in fairness be taxed with presumption, if he considers himself justified, after twenty eight years of experiment and evolution, in raising his modest "studies" to the rank of a system of the natural order of the Universe, based upon scientific principles. Nor will it be deemed unwarrantable arrogance or self-laudation

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on his part if he ventures to point out that the advances and conquests made by science in the course of these twenty eight years have in no one point controverted the theories put forward in the first edition, but have, on the contrary, confirmed them in various directions and in the most astonishing manner. This has especially been done in the department of natural philosophy by the wonderful discovery of spectral analysis and the universal recognition of the law of the conservation of energy and the transmutation of forces; in the department of astronomy by the further discoveries on the condition and movements of distant heavenly bodies and the universality of natural laws; in that of geology by the corroboration of Lyell's theory of stability; in anthropology by the demonstration of the descent of man from animals and of the antiquity of the human race on earth; in the department of biology by the powerful influence of Darwin's famous theory of evolution and by the facts that go to show the genesis of the lowest primal organisms, as well as by the entire abandonment of the baleful theory of design: in that of anatomy by the discovery of the cell as the fundamental form of the organic world, and by its being clearly proved that the brains of men and of animals are not fundamentally distinct from one another; in that of physiology by those investigations on the localisation of the functions of the brain which form a landmark in the history of science at large, and by the total rejection of the theory of vital force; in the department of chemistry by the gigantic strides made by chemical synthesis; in that of psychology by the searches made into the psychical and intellectual life of animals, and by the abandon-

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ment of the theory of instinct, induced by a clearer understanding of the laws of heredity. All these discoveries had either not been made, or were still in an embryonic state, when the author first put pen to paper in the year 1855; and yet this imperfect state of our knowledge did not prevent him, impelled, as he felt, by the want of philosophical unity, from getting at views which have received such a thorough confirmation and have been so fully complemented by the progress of science within a comparatively brief space of time. On this account the author has felt justified in reinstating, either wholly or in part, various expressions and utterances contained in the first edition of this book, which appearing to him to go to rather an undue length, he had, under the pressure of the general and passionate opposition, expunged from the subsequent editions. For instance, in the chapter on Free Will contained in the first edition, there were certain remarks — afterwards omitted — which dealt with the moral consequences of his views on natural philosophy. These remarks have been restored and amplified in this edition in a special chapter on *Morality*. The author has felt himself all the more bound to do this, since one of the objections most frequently urged against his views, is that he was destroying the old faith and putting no new one in its place. No doubt, the belief in the existence of a natural order in the universe is *at least* as good as, and in reality far better than, a belief in the existence of an order of things antagonistic to nature, as has already been proved to demonstration by *D. Strauss*, in his famous book on "The Old Faith and the New." Yet the author thought it right not to omit to supply

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facts which prove so very clearly that morality is compatible with a natural order of things, and to shew to those who accept the new faith that, in doing so, they lose nothing in moral value either in their own eyes or in those of Society at large, but that on the contrary they have only to gain by it. The reader must judge for himself whether or not the Author has succeeded in furnishing this demonstration.

The Author has held that the prefaces to the editions, published subsequent to the first, might be omitted without any detriment to the book. They have for the most part lost their former special interest, since the combats waged around the book have now exhausted their fury, and are not likely to arise again as before. In fact, the Author is now so situated as to stand no longer in need of such commentaries, having in the meanwhile published a large number of additional writings, which further develop and complete the views laid down in "Force and Matter" in all essential points. In order to render the task as easy as possible to the reader who might desire to refer to these additions and further developments, the Author has throughout, wherever it appeared suitable or needful, given in foot-notes the references to the works relating to the subject. Those who would like to take cognizance of those prefaces can obtain them from the publishers, printed in a separate form for the use of readers. The Author does not intend to enter on further polemics and controversies with his opponents, in the way he used to do; for the fact of his enemies being so very numerous, he derives comfort and consolation from the old German saying, "He who has many enemies, is much honoured." Well

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does he know that, like all men, he is liable to error, but that, as *Lessing* says, — "The value of a man does not depend on the truth he possesses or believes he possesses, but on the sincere labour he has bestowed upon getting at the truth: for it is not the possession of, but the search for truth, that increases his strength and thereby makes him more perfect." This sincere labour undertaken with the object of getting at the truth, or an ardent love of truth, simplicity and candor, could alone induce the author to issue this book, in which he has placed himself in such a keen and to him most distasteful opposition to the ruling ideas and authorities of his own time. It is not the present age, but a remote future which he himself will never live to see, that can and will do justice to his intentions. Looking at things in this light, he thinks he may bid farewell to the host of those who have been his opponents, by quoting the following brief verses: —

Wer richtet zwischen mir und Euch? —
Nicht ein Geschlecht, dess schwache Art,
An allen Vorurtheilen reich,
Von Eurer Hand erzogen ward!

Doch Einstens, wenn mit jähem Fall
Zusammenbricht der Lüge Reich,
Dann spricht die Zeit zum Zweitenmal
Das rechte Urtheil mir und Euch!

(Who shall judge between you and me? Not a race of feeble type, rich in prejudices, and trained by your hand! But some day, when the realm of lies shall have come down with sudden crash, then shall time deliver an equitable judgment upon you and me!)

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As regards the verses that are scattered here and there through the book, they were mostly contained in the earlier editions, but had subsequently been struck out for want of space. The prefaces having now disappeared, there was no further reason for omitting them, and they have therefore been re-instated. In those cases in which the name of the poet is not given, they are the Author's own productions.

Finally, it may be noted that the book in its new shape is being issued simultaneously in German, in English and in French.

Darmstadt, April 1884.

The Author.

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FORCE AND MATTER.

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FORCE AND MATTER.

"The universe, that is the All, is made neither of gods nor of men, but ever has been and ever will be an eternal living Fire, kindling and extinguishing in destined measure, a game which Zeus plays with himself."

Heraklitus of Ephesus.

"He to whom time is as eternity, and eternity as time, is free from all turmoil."

J. Böhme.

(Where there are three students of nature, there are two atheists.)

"Force is no impelling god, no entity separate from the material substratum; it is inseparable from matter, is one of its eternal indwelling properties." "A force unconnected with matter, hovering loose over matter, is an utterly empty conception. In nitrogen, carbon, hydrogen, oxygen, in sulphur and phosphorus, their several properties have dwelt from all eternity." (Moleschott.)

"Fundamentally, as is readily seen, there exists neither force nor matter. Both are abstractions of things, such as they are, looked at from different standpoints. They complete and presuppose each other. Isolated they are meaningless" and so on. "Matter

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is not a go-cart, to and from which force, like a horse, can be now harnessed, now loosed. A particle of iron is and remains exactly the same thing, whether it shoot through space as a meteoric stone, dash along on the tire of an engine-wheel, or roll in a blood-corpuscle through the veins of a poet. Its properties are eternal, unchangeable, untransferable." (Dubois-Reymond.)

"Nothing in the world authorises us to suppose the existence of forces in and by themselves, without bodies, from which they can go out and on which they work." (Cotta.)

"As we can think of no force without a material substratum, so we know of no matter which is not connected with a number of forces." (F. Mohr.)

"Force without matter is not a reality, and both by their union have made the world and all its phenomena. Without matter no force, without force no phenomenon, also without matter no phenomenon." (Ph. Spiller.)

"We know of no matter which does not possess force, and on the other hand we know of no forces which are not joined to matter." (Hæckel.)

"To regard matter as passive, and to suppose a force working on it from without, is so grave an error that it would not be possible to fall into it if inborn and mystical fancies did not cloud the mind. Matter and force, like force and matter, are no separable entities, but different conditions of one and the same thing." (F. Vignoli.)

"Matter and force are separable only in thought; in reality they are one." (A. Mayer.)

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"We must hold firmly to the principle that matter and force are indivisibly joined together, so that force without matter has no independent existence." (S. Cornelius.)

"It is apparent that all attempts to isolate forces from matter, and *vice versâ*, are only one-sided abstractions, depending on the notion that force and matter may be found in Nature as distinct entities, because in speech they are distinct words." (Weis.)

"The first and last word of Science will always be the indivisible union between or the identity of force and matter." (A. Lefèvre.)

With these quotations from well-known investigators, learned men and authors we commence a chapter that is to serve as a foundation for the subsequent investigations into one of the simplest and weightiest of truths, which is, perhaps, for that very reason, one of the least known and least recognised. No force without matter — no matter without force. One is no more possible, and no more imaginable by itself than the other. Separated from each other, each becomes an empty abstraction or idea, which is only useful as shewing two sides or manifestations of the same existence, the nature of which in itself is unknown to us. Force and matter are fundamentally the same thing, contemplated from different standpoints. In the material world we know of no example of a particle of matter not endowed with force or working by it. We must further admit on closer investigation, that matter as such could make no impression on our sense-organs or

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minds; it can only do this by means of the forces united with or at work within it. A piece of lead held in the hand presses on it because of the attractive force of the earth and so produces the idea of weight. Neither can we imagine an ideal substance of forceless matter. Think of what original substance we may, a system of reciprocal attraction and repulsion must always exist between its smallest particles, and this is the cause of the subsequent changes, and the relationship of each particle with the others is regulated or controlled by forces which lend their properties to the combinations or forms arising thereout. "A thing without properties," says *Drossbach*, "is an absurdity, neither imaginable in reason nor experienced in Nature." "As water flows through the fingers," forcibly remarks *A. Laugel*, "so disappears the idea of matter, as soon as we try to separate it from the idea of motion or of force, just as if we seek to part it from that of shape."*)

Equally empty and untenable as the notion of matter without force, is that of force without matter. Only the superstition or ignorance of former centuries could regard as possible the existence of forces in

*) Hence comes it that we are learning more and more to regard Chemistry or the science which deals with matter (as was partly done in the 17. and 18. centuries) as a branch or subdivision of Physics, the science which deals with force. Perhaps, and even probably, the distinction between chemical and physical forces lies only in this, that the first deals chiefly with the so-called atoms, the minutest particles of matter, while the second deals chiefly with the molecules, groups of like or unlike atoms. Or, in other words, Chemistry may be regarded as the mechanics of the atom, Physics as the mechanics of the molecule. —

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Nature which act apart from matter; such possibilities are to-day wholly banished from science. Nothing can prove to us the real existence of a force, except the properties, changes, and movements, which we become conscious of in matter, and these we call different "forces" according to the resemblances or differences in such manifestations; any knowledge of them by other ways is impossible. If we try to think of an Electricity, a Magnetism, a Weight, a Heat, a chemical affinity, etc. without the substances in which we have observed the manifestations of these forces, or without those material particles the molecular interaction of which gives rise to the manifestations — nothing remains to us save an empty idea, a wordsign, which we can only use in order to designate and separate off a certain class or group of material phenomena. Any real conception of what forces are in themselves, or what force can be outside matter, escapes us just as does the idea of what material bodies or matter would be without force. In strictness we cannot speak of Electricity, but only of the electrical condition of or of electrically excited matter. We cannot speak of Light, but only of shining bodies, of bodies giving light by vibration; nor of Heat, but only of a change in the reciprocal positions of vibrating atoms or molecules from their so-called statical condition; nor of Weight, but only of bodies which exercise pressure by gravitation, and so on. —

All the so-called imponderables — a name which designated formerly as matter incapable of being weighed certain forms of force, as Heat, Light, Electricity, Magnetism — are neither more nor less than

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changes in the reciprocal conditions or the active state of the minutest particles, changes which are transmitted from one body to another, from material to material, by a kind of contagion or transference of motion. Hence forces, as *Mulder* well points out, cannot be imparted or made, but only excited, or changed from a latent to a free or cognisable state. Magnetism cannot be transferred, as it would seem, but only evoked or opened up as we change the inner active condition of its medium. The magnetic forces are present in the molecules or smallest particles of the iron and are — as for example in a magnet — strongest exactly in the part where they are least or not at all noticeable from without, i. e. in the middle. *Heat* — that most ancient and essential force of Nature which is ceaselessly at work everywhere and can be changed into all other forms of force or can be obtained from them — is not, as was once thought, imponderable matter, passing from body to body, but molecular or atomic motion, an exceedingly swift, trembling, swaying or vibrating movement of the smallest particles or molecules of a body, whereby at the same time these particles recede from each other, while under the influence of the contrary or of cold they press more closely together. Heat and Cold are only to be distinguished by the fact that this molecular motion in a relatively cold body is less energetic than in one relatively warm. Heat is also generally manifested by the expansion, Cold by the contraction of the material; we know, as *Grove* (Correlation of Physical Forces) remarks, "nothing but the constant change of matter whereof Heat is the universal sign; the entity

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Heat is unknown to us." Similarly with *Light*, which, according to the latest discoveries, must be looked upon as identical with Heat, since the difference is only the difference in the number of the ether-vibrations and the vibrations of the molecules of bodies caused by these; this is no imponderable matter, as was once supposed, but an inconceivably swift vibrating or wave-like motion of matter, of the atoms of the unaggregated matter filling space and penetrating into all bodies, the infinitely rare light-ether; a motion which according to circumstances is now Light, now Heat, now Electricity, now Magnetism, now chemical affinity. So also *Sound*, resembling Light in its motion, is no hearing-matter, carried by the air to the ear, but is only the moving air itself, which imparts its movement to our organ of hearing.

The remarkable and brilliant prospects opening in the future to the force of *Electricity* do not rest, as was first thought, on the existence of a so-called electrical fluid, that flows from body to body; on the contrary, late investigation into electrical action teaches us to regard it as merely a change of condition of the universal material or matter. "When we throw a glance around all the known groups of electrical phenomena or manifestations", says *Grove* (see ante), "we do not find a single one that cannot be relegated to a change of the molecules in the electrically excited substance. For instance let the charge from a Leyden jar be sent through a platinum wire; it will be found that the wire has shortened, so that molecular change must have taken place. If the discharge is continued, the wire will

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at length rise into little folds or actual irregularities. A lead wire swells into knots, which press on each other, as bodies of a soft substance threaded against each other on a string. Further, metallic wires through which an electric current has been passed for a long time, gradually change their internal structure and become sometimes stronger, sometimes more brittle. Magnetism also changes the elasticity of iron or steel, and a bar slightly bent by its own weight straightens itself when magnetised." In a similar way bodies are acted upon, according to *Grove, (mutatis mutandis)* by all other forces. Thus, for instance, the chemical dissociation of compounds, whose elements are very weakly united, can be brought about by purely mechanical causes, *e. g.* by the vibrations produced by a sound in the air.

In a still greater extent is this true of the vibrations of light, which bring about the most startling chemical reactions, sometimes decompositions of chemical compounds, sometimes unions of chemical elements; as an instance of the latter we may take the explosive union of chlorine and hydrogen into hydrochloric acid by the action of sunlight, and of the former the decomposition of the carbonic acid of the air by the vegetable kingdom under the action of light. This also shows how the so-called latent forces or energies — among which, besides the chemical difference or affinity, must be reckoned the weight or general mass-attraction and the cohesion or molecular force — can be changed every moment into living or active forces or can be drawn out of the latter, and how therefore in these also we can only speak of the condition or movements of molecules. Whether

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this condition manifests itself in a possible or in a real movement, whether only an activity or a true motion of the force-bearer results, makes in reality no difference. The time no longer appears far off when science will be able to derive all forces without exception not merely out of capacity for motion but out of motion itself.

On these grounds the investigators and authors named at the beginning of this chapter define force as a mere property of matter or as its capacity for work. To put it more accurately, Force may be defined as a condition of activity or a motion of matter or of the minutest particles of matter or a capacity thereof; yet more precisely, as an *expression for the reason of a possible or actual movement* — differences which in reality alter nothing in the matter itself. Force can no more exist without Matter, than seeing without an organ of sight, or a thought without an organ of thinking. "No one has ever thought", says *Karl Vogt*, "of maintaining that secretion can exist separate from the gland, or contractility separate from the musclefibre. The absurdity of such an idea is so striking that nobody has ventured to think of it in connexion with these organs."

"Not outside matter, or outside bodies is the supposed force or property found, but only within them; and the thought that affinity (Force) has a separate existence outside the bodies in which it inheres or to which it gives the capacity for their particular demeanour, is so utterly monstrous, so wholly incomprehensible, that it is almost an insult to common sense to further enlarge upon it." (A. Mayer.) —

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What general philosophic consequence is deducible from this simple and obvious fact?

That those who talk about an independent or supernatural creative force, which has evolved the universe out of itself or out of nothing, are in antagonism with the first and simplest axiom of a philosophical view of nature, grounded on experience and reality. Neither can force create matter, nor matter force, for we have seen that a separate existence of these is neither empirically possible nor logically imaginable. But things which cannot be separated can never exist separately. That the universe cannot have arisen from nothing we shall find presently, when we treat of the conservation or eternity of matter and force. Nil is as much an empirical as it is a logical nonentity, a general negation of all existence. Never can nothing become something, nor something nothing. *Ex nihilo nihil fit, et in nihilum nihil potest reverti.* (Lucretius Carus.) The universe or matter with its properties, conditions or movements, which we name forces, must have existed from and will exist to all eternity, or — in other words — the universe cannot have been created. If we are to accept such a creation it must first of all be proven to us how it is possible or imaginable that something can come out of nothing — which is an impossibility. It must further be shewn how it is possible or thinkable that the creative force which is to be regarded as the cause of the universe, existed before the creation, without creating or without activity — and this is a still greater impossibility. The conception of an inactive creative force without any real existence besides itself is as impossible as that

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of Force without Matter. If however an original chaos is supposed, into which at a given time the creative force introduced order and reason, then is the idea of creation as such given up, and we come back to the eternity of the universe, which, as will be presently shewn, excludes or renders superfluous any creative or regulating principle. What educated person, in the face of the discoveries of modern science, or even with a superficial acquaintance therewith, can seriously doubt that the universe is not — as used to be said in the phraseology of theological cant — governed, i. e. led or guided by a force outside itself, but that, in all its movements and transmutations, it obeys a manifest necessity of nature from which there is no exception? Never and nowhere, at no time, nor in the furthest realms of space to which our telescope reaches, can one fact be demonstrated with scientific certainty which contradicts this natural necessity and admits or necessitates the admission of an active self-conscious force, outside the natural order of the universe. If man will have a creative force, an absolute power, a world or original soul, an unknown x — no matter by what *alias* it goes — as the cause of the universe, then must he say, applying to it the idea of time, that it could exist neither before nor after the creation. It could not exist before it, for the reasons already stated; it could not exist afterwards, because again rest and inactivity cannot be connected with the conception of such a force, and would abrogate it. A creative force that does not manifest itself and that shews no sign of its presence cannot exist, or at least cannot in any way be taken into account in our thought. *De non*

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apparentibus et non existentibus eadem est ratio. (The non-apparent and the non-existent must be treated in the same way.) If the creative force after creation is to be regarded as sunk in eternal self-contented repose or in inward self-contemplation, this can only be taken as a philosophical fancy picture, without any real or trustworthy basis.

There remains only a third possibility, i. e. the superfluous and monstrous conception that the creative force suddenly and without any definite reason emerged from Nothingness, created the universe (out of what?) and directly the work was done, sank back into itself, in some measure embodied itself in the world, or dissolved into the universe. Philosophers and laymen have always clung to this theory, because they hope in this fashion to reconcile the undeniable fact of an invariable and established order of nature with a belief in a supernatural, independent, creative principle. Most religious conceptions lean more or less towards this idea, but with this difference that they regard the universal spirit as indeed resting after creation, but as a higher power which can at any time and at his own will suspend or alter the laws of nature. This may suffice for those who would solve the problem of the universe by faith. But for those who here also take reason and logic as their rule, this conception is as inadmissible as its fellows. The very application of finite conceptions of time to the creative force entails an incongruity; a still greater one is its rise from the *nil.* A creative force that either creates itself or arises from nothing, and which is a *causa sui* (its own cause), exactly resembles Baron Münchhausen, who drew

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himself out of the bog by taking hold of his own hair. If, in order to avoid this difficulty, we give the attribute of eternity to the creative force, then this is merely another phrase for the eternity of the universe, which, as we have already seen, excludes or renders superfluous every creating principle. The useless search of philosophers for a cause of the universe is a *regressus in infinitum* (a stepping backwards into the infinite) and resembles climbing up an endless ladder, the recurring question as to the cause of the cause rendering the attainment of a final goal impossible. At any rate the existence of the universe with its perfections and imperfections, with its for ever and ever interacting processes of development and reversion, is a more possible and more intelligible conception than the theory of a perfect self-conscious creative force springing from a reasonless Nothing.

If therefore the creative force cannot have existed before the universe came into being; if it cannot exist after the same event; if it is not imaginable that it existed only for a moment; if Matter and Force (as will be presently shewn) are indestructible, and if there is no matter without force, no force without matter — there can remain no doubt that the universe was not created, that it was not called into life by some will residing outside itself, but that it is eternal. That which has neither beginning nor end in time or space can have none in existence. That which cannot be destroyed cannot have been created. "Matter is uncreatable as it is indestructible." (Carl Vogt.) "If matter is indestructible, then it is also uncreated." (Spiller.) "The Universe as a totality is without cause, without origin, without end." (Du Prel.)

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Simple and self-evident as may appear to us, in the present state of knowledge, the inseparability of the conceptions of Force and Matter, this has not always been so, and human reason only attained that simple idea after passing through many phases of ignorance or error. For the simplest idea of a matter, as *Grove* very well remarks, is generally that to which the human mind turns last; and simplicity is the hall-mark of truth. (*Simplex veri sigillum*). According to one of the excellent essays of the English thinker Bence Jones, the conceptions of Force and Matter have passed through three separate and distinct phases of development, in the last of which we now are. In the first phase, men regarded Force and Matter as two wholly distinct entities and bestowed separate names on the self-existent forces of nature or their manifestations, regarding them as the results of the activity of certain supernatural beings (*vulgo* gods). Thus earth, heaven, air, water, wind, stream, light, fire, sun, darkness, day, night etc. each had its own spirit or god. Thus, among the Greeks, *Zeus* was the god of thunder and lightning, while his consort *Hera* represented rain and vapor; *Phoebus* was the god of the day, his sister *Artemis* the goddess of the night, *Uranus* represented the sky, *Gaïa* the earth, *Poseidon* the sea, *Hephaestos* the fire, *Aeolus* the winds, *Aphrodite* the power of fascination, and so on. The ancient Indians, Chinese, Egyptians, Persians etc. held similar views. The Greek philosophers, although several among them cherished very refined cosmological theories, generally made a very sharp division between Force and Matter and regarded the latter as moved from without, being itself incapable of move-

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ment — a theory which held its ground until the times of Descartes and Newton, owing to the vast influence of the Aristotelian philosophy. This first phase was followed by the second, in which, instead of a complete separation between Force and Matter, there was an incomplete separation of these concepts. Force was then united in some way to ponderable matter, but was fundamentally something quite different, being itself a kind of matter that could not be weighed, *i. e.* an imponderable. From this theory resulted the famous but now discredited emanation or emission theory of light, according to which light consisted of minute imponderable particles, travelling with inconceivable rapidity. Heat was regarded as a fluid conveyed from body to body: in similar fashion Electricity and Magnetism were looked upon as special electrical and magnetic fluids. The belief in the famous Phlogiston or combustible principle — which was supposed to be the cause of combustion, and which was set aside at the end of the last century by the discovery of oxygen — comes in under this head; it is the same with the spirit of amber, which Thales gave as the reason for its property of attraction, and so with many others. In the third phase only, the phase of modern thought, has it been recognised that there is no such thing as imponderable matter, and the unity, unchangeability and indestructibility of the force-endued atoms have been discovered. This is the phase of the unity and inseparability of Force and Matter, in which it is seen that, for instance, there can no more be matter without attraction or weight, than force of weight or attraction without matter, and that all known forces and

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activities only consist in the conditions or movements of the smallest particles of matter. Wherever matter is found, there must also be force in a state of motion, tension and resistance, and *vice versâ*.

Moreover we find, as might be expected, many stages of transition between these phases. The most difficult one to set aside is the dualistic hypothesis of Force and Matter in Biology, the Science of Life, which, in consequence of the complicated and therefore less easily traced relationships of the transmutations of organised matter, stands chiefly in the way of a more accurate theory. Thus, for instance, the famous physician, *Paracelsus*, did not venture to represent the physical functions of nutrition, digestion, secretion, etc. as what they really are, the functions or activities of their proper bodily organs, but described them as the work of certain vital spirits. In similar fashion appeared later on the "Archæus" or "stomach-spirit" of van Helmont, Borelli's „nerve-spirit", Hofmann's "life-substance", Haller's "irritability", Stahl's *"Anima animata"* and the whole host of names of nerve-force, imagination-force, vital-force, force of the circulation of the blood, etc. which in the science of life took the place of the imponderables of inorganic nature. Here too Force is considered as a subtle fluid substance or an imponderable elementary principle, whose previous union with material bodies was dissolved at death. We are sorry to confess that biological hypotheses have not yet completely got out of the second phase, and that the ghost of "vital force" — which will be fully dealt with in a later chapter — still haunts many wise heads, notably those of philosophers, while the physical

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and chemical sciences have long since passed into the third and last stage.*)

*) Further details on the relationship of Force and Matter may be found in the author's "Natur und Geist." 3rd. edition, pp. 1—105; and on the history of the theories of Force and Matter in his "Licht und Leben," 1882, pp. 111—118.

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IMMORTALITY OF MATTER.

"From nothing nothing. Nothing that is can be annihilated."

Democritus.

"It is an indubitable fact, proved by a thousand chemical experiments, that no ponderable bodies or elements can perish nor disappear, and equally that no new ones can originate. The property that cannot perish in time cannot be evolved in time. That which cannot be destroyed cannot be originated. It follows that matter has existed from eternity, that it was neither created nor evolved, that its totality which is infinitely great can be neither increased nor diminished, and this also on the ground that the infinitely great cannot be increased by the addition of the finite, and that its characteristic of indestructibility includes that of non-creation."

F. Mohr.

"Although in the course of ages catastrophes have taken place in the heavens, and still take place, although ancient systems dissolve and new systems are built up out of their ruins, yet the molecules of which these systems consist, the foundations of the material universe, remain unbroken and uninjured."

C. Maxwell.

"Imperial Cæsar, dead and turned to clay,
Might stop a hole to keep the wind away;
Oh, that that earth, which kept the world in awe,
Should patch a wall to expel the winter's flaw!"

Shakespeare (Hamlet, act. V., sc. 1.)

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With those words, the outcome of the keenest, perceptive ability, the great Briton pointed out, three hundred years ago, a scientific truth, which, despite its clearness and simplicity, despite its unanswerableness, has not yet attained that general recognition which is its due. Matter as such is indestructible, it cannot be annihilated; no grain of dust in the universe can vanish from, and none can enter it. It is the greatest service rendered to us by chemistry that for the last hundred years it has taught us this indubitable fact, that the unceasing changes and transformations of phenomena, which pass daily before our eyes, the formation and destruction of organic and inorganic forms and figures, do not consist of the formation of matter previously non-existent, nor of the destruction of matter then present, as was generally thought in earlier times, but that this change consists in nothing save in a continual and unbroken rotation of the same substance, of which the mass and the quality remain unalterable and identical for all ages. By the aid of the balance matter has been pursued through its manifold and hidden ways, and it has always been found to issue from a combination the same in mass and in properties as when it entered into it. The calculations which have been founded on this law of the indestructibility of matter have proved correct throughout. We burn a piece of wood, and at the first superficial glance it seems as if its particles had perished or been destroyed in fire and smoke. But this destruction is apparent only, for the balance of the chemist tells us that not only have that wood and its constituent particles lost nothing, but that on the contrary the total weight of

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the constituents of the wood has increased; it shows us that the products, gathered and weighed, consisting of the gases evolved in combustion and the ashes left behind, not only contain all the matter of which the wood originally consisted, although in a different form and composition, but that in addition other materials are contained therein, with which the constituents of the wood united during the combustion. In a word, the wood by the occurrence of combustion has increased, not diminished the total weight of its constituents. "The carbon of the wood", says Karl Vogt, "is imperishable, it is eternal and therefore indestructible, as are the hydrogen and oxygen with which it is combined in the wood. This combination and form into which it enters are destructible, but the material perishes not." — "Carbon", says Czolbe, *(Neue Darstellung des Sensualismus — New Exposition of Sensationalism — 1855)* "which we find in the spar crystal, the wood fibre, or the muscle, can after the destruction of those bodies enter into other combinations of different appearances, but as an element it can never be changed and never be destroyed."

If we bury a dead body we find years afterwards nothing in the place save a heap of bones mixed with earth. The sight awakens the belief that there is nothing more left of the former constituents of the body committed to the ground beyond these remains, but science tells us that in reality nothing, not even the smallest particle thereof, has been lost, but that the whole change consists in this, that the elements have left their former combinations and have returned to the rotation of matter, to-day in this, to-morrow in that form to pursue their endless course. With full

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justification then did the bold fancy of the British poet follow the matter which once helped to build up the body of imperial Cæsar to the point at which, in the shape of earth or mortar, it patched up a hole in a wall.

With each breath that passes from our lips we exhale part of the food we eat and of the water we drink. They change so quickly that we may well say that in a space of from four to six weeks we are materially quite different and new beings — with the exception of the skeletal organs of the body, which are firmer and therefore less liable to change. The atoms, or the smallest particles of the chemical elements, change, but the manner of combination remains the same. Those atoms are themselves unalterable, indestructible; to-day in this, to-morrow in that combination, they build up by the variety of their positions or their unions the countless different forms in which matter presents itself to us, speeding from one to another in a ceaseless change and flow. At the same time, the quantity of atoms of a simple element remains on the whole unchanged; not one of these particles of matter can form itself anew nor add to itself; none that has once existed can disappear from being; none can change its nature. An atom of oxygen, of nitrogen, of hydrogen, of iron is everywhere and under all conditions one and the same thing, endued with the same inseparable properties or energies, and can never to all eternity become anything else. Be it where it may, it will be the same being everywhere; however different the compound may be, it will issue from it on its breaking-up the same as it was when it entered into combination. But it can never

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originate anew nor vanish out of existence, it can only change its combinations. The same atom which to-day helps to form the haughty mien of a sovereign or a hero, may perchance lie to-morrow as the street-dust beneath his feet. The same atom which to-day drones in the brain of a sheep, may perchance to-morrow aid the thinking of a philosopher or of a poet. The same atom which to-day forms part of dirt or manure, may perchance to-morrow sleep with its fellows on the flower-bud as fragrant bloom.

"A simple elemental atom", says B. Stewart, "is really an immortal being and rejoices in the power of remaining unchanged and unmoved in its being under the mightiest attacks which may be levelled against it; it is probably in a condition of ceaseless movement and change of form, but remains none the less evermore the same."

"An atom of hydrogen", says the anonymous author of an essay on the Philosophy of Chemistry (*Revue Philosophique*, 1880, No. 6) "will ever remain a hydrogen atom, to whatever tests it may be submitted. If it enters into any combination, or leaves it again, it remains still the same, it always possesses the same properties. The necessary consequence of this is that the indestructible atom cannot be created."

This eternal and ceaseless ebb and flow of the minute particles, changeless in themselves, has been called transmutation of matter by scientists, and science offers countless examples and proofs thereof. It is enough to remark of the changes and cycles through which matter passes in the Universe, and which man has partly followed by balance and measuring-rod, million-fold and ten millionfold, that they are without end

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and limit. Dissolution and generation, destruction and re-formation clasp hands everywhere in an endless circle. In the bread that we eat, in the air that we breathe, we draw in the matter that once built up the bodies of our forefathers; nay, we ourselves give every day a portion of the matter forming our bodies to the outside world, and shortly after we re-take this substance or matter similarly given off by our neighbours. Of the English we can literally say that they gratefully repay their forefathers who fell fighting for them and their freedom against the French Empire, by eating them as daily bread, for the bones from the battlefield of Waterloo were carted off in great quantities to England for manuring the fields, the yield of which was very much increased thereby.

But, as we have said, no further proof is needed to demonstrate that matter is indestructible, and that it cannot therefore be created. How can that be created which cannot be annihilated? Matter must have been eternal, is eternal, and shall be eternal. "Matter is eternal; it changes only its forms." (Rossmæssler.)

The eternity of matter, or of substance, appears also from the following consideration: Science teaches us that an absolute vacuum cannot exist, and never can have existed, while the infinity of space is set down by reason as axiomatic. Hence follows necessarily the conclusion that space must have been filled with matter, and that this must have existed from eternity. It follows, in addition, as was shewn in the preceding chapter, that the universe must be uncreated. A beginning and an end of the universe

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are as such inconceivable, and must be relegated to the limbo of spiritual or theological fancies.

The phrases "mortal body" and "immortal spirit", which have been repeated *ad nauseam*, are misnomers altogether. Exact thought might possibly reverse the adjectives. The body in its individual form or shape is indeed mortal, but it is not so in its constituent particles. Not in death only but throughout life it changes unceasingly, as we have seen; but in the wider sense it is immortal, since not the smallest particle of it can be annihilated. On the other hand we see that what we call spirit, soul, consciousness, disappears with the cessation of the individual combination of matter; and it must appear to the unprejudiced mind that this action having been brought about by peculiar and very complicated unions, must come to an end with its cause, that is to say, with the cessation of those peculiar combinations.

To-day the indestructibility or permanence of matter is a scientific fact firmly established and no longer to be denied. It is interesting to observe that former philosophers and thinkers also possessed a knowledge of this important truth, although in an incomplete form and rather as a presentiment than as a scientifically known and established certainty. The experimental proof thereof could only be yielded by our balances and retorts.

Sebastian Frank, a German, who lived in 1528, says: "Matter was from the beginning in God, and is hence eternal and unending. The earth, the dust, every created thing indeed perishes; but we cannot say that that perishes out of which they are created. Substance abides eternally. A thing falls into dust,

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but out of the dust is developed another. The earth, as *Pliny* says, is a phœnix and remains once for all. When it becomes old it burns itself to ashes that out of them a young phœnix may arise, the former but rejuvenated."

Yet more directly to Italian philosophers of the Middle Ages express this idea. *Bernard Telesius* (1508) says:

"Bodily matter is alike in all things and remains ever the same; dark sluggish matter can neither be increased nor diminished."

Finally *Giordano Bruno,* (who was burned alive in Rome in 1600), remarks:

"That which was seed at first, becomes grass, hence the ear, then bread, nutritive juice, blood, animal seed, embryo, man, corpse, then again earth, stone or other mineral and so forth. Herein we recognise therefore a thing which changes into all these things and essentially remains ever one and the same. Nothing appears to be really durable, eternal and worthy of the name of a principle save matter only. Matter as the Absolute includes within itself all forms and dimensions. But the infinity of forms under which matter appears is not accepted by her from another nor as it were only in outward appearance, but she brings them forth from herself and bears them from her own womb. Where we say there is death, there is only the outgoing towards new life, a loosing of one union which is the binding into a new."

But a yet far more remote age was not unacquainted with the outlines of this truth, which now appears likely to become the corner-stone of every exact or experimental philosophy. *Empedocles,* a Greek

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philosopher who lived 450 years B. C., says: „They are children or persons of narrow views who imagine that anything originates which before was non-existent, or that anything can wholly die or perish." And again before him had the Greek philosopher *Anaxagoras* (B. C. 500—428) taught: "Existence in space neither increases nor diminishes"; while his contemporary *Democritus*, the famous parent of the materialistic philosophy of the old world and of the theory of atomicity, formulated very plainly the hypothesis of the indestructibility of matter and defined the position as follows: "Out of nothing arises nothing; nothing that is can be annihilated. All change is only the union and separation of particles. The varieties of all things depend on the varieties of the atoms in number, size, form and arrangement" etc.

*) "For further details on the historical development of the theory — ancient in its most general meaning — of the stability or unchangeableness of matter see the author's work *"Die Darwin'sche Theorie in sechs Vorlesungen"* (Leipzig 1876 IV. Aufl.), lectures V and VI.

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IMMORTALITY OF FORCE.

"In Nature nothing is lost, nor Matter, nor Force, nor mechanical work."

P. A. Secchi.

"No zephyr breathes, no wavelet ripples on the bank, but the movement thrills through all space."

H. Tuttle.

"Out of nothing no energy can arise."

Liebig.

"Motion, Heat, Light, Magnetism, Electricity, chemical affinity pass one into the other; they are only different modes of one and the same original energy and each if not direct'y can yet indirectly be converted back again into the old form out of which it has been evoked."

Dü Prel.

Equally uncreatable, equally indelible, equally imperishable, equally immortal as Matter is the Force bound up with it. United in infinite amount to the infinite mass of Matter, in most intimate union therewith, and like matter, it runs in an unresting never-ending circle and emerges from each mode or union exactly the same in amount as when it entered in. As it is an indubitable fact that Matter can be neither newly created nor annihilated, but only changed in form, so must it be accepted as an absolutely certain experience that there is not a single in-

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stance in which a force has been brought out of nothing nor reduced to nothing, in other words *born* nor *annihilated.* In all cases in which forces make their appearance they can be traced back again to their *sources*, that is it can be shewn out of what other forces or energies a given amount of force has been obtained directly or through transmutations. This transmutation does not proceed arbitrarily, but according to definite equivalents or weight-numbers, so that the minutest amount of force can no more be lost than the minutest amount of matter in the transformation of matter.

While the indestructibility or permanence of Matter has been a known and settled fact for about a century past, this is not equally the case with the indestructibility or conservation of Force, which, despite its great simplicity and ever self-evident character, has only been observed by scientists during the last forty years — and not without almost insuperable obstacles to general recognition being opposed at first to the new truth. We call it simple and self-evident, because it follows immediately and without further argument on the simple consideration of the relationship between cause and effect, and because a solitary instance in which the conservation of Energy failed, must have brought about the final stoppage of all motion in the universe; in the second place because the law of the indestructibily of Matter necessarily includes within itself the indestructibility of Force. When *Lavoisier*, in the year 1774, discovered the nature of combustion and put oxygen in the place of phlogiston or combustible air, the theory of the indestructibility of Matter and of the

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eternity or indelible nature of atoms was proved simply from the results given by the balance. Had the same theory of the relationship between Matter and Force been known then as it is now, the thesis of the indestructibility of Force would at once have been recognised as a necessary consequence. For if forces in the most general sense represent the properties of Matter, and if by means of them motion and change enter into life, then it is self-evident that the totality of forces present in Nature, whether static or dynamic, must also remain the same, that is can neither be increased nor lessened. But since scientists are a suspicious folk and will only accept that for truth which can be demonstrated by experiment or by calculation, and since it is far more difficult to measure and calculate forces then to weigh matter, so the rotation of forces, analogous as it was to and implied in the rotation of Matter, remained hidden for more than half a century, until in the year 1837 *F. Mohr* distinctly noted it in his treatise "On the nature of Heat". He was followed in the year 1842 by *R. Mayer*, who first calculated the mechanical equivalent of Heat, and later on by the Englishman *Joule* (1843—49) who, without knowing of his predecessors, carried out during several years experiments on the relation between Heat and Work, or Heat and Motion, and by these experiments raised the connexion of these forces to an indisputable theorem. But not until between 1850 and 1860 and a long time after the publication of the first edition of this work, this theorem was recognised and demonstrated as regards the remaining forces; it rejoices to-day in an uncontested recognition, so that, as *F. Mohr* says,

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it has become the polar star whereby scientists now direct their course.

According to this theory, no motion in Nature arises from nothing nor passes into nothing, and as in the material universe each individual form can only realise its existence by drawing upon a vast and never changing store of matter, so each motion forms the basis of its existence out of an incommensurable, never changing store of force and returns this borrowed quantity of energy sooner or later in some fashion or other to the Whole. A mode of motion may indeed be *latent,* that is to say, it may pass for the moment into *apparent* hiding, but it is not therefore lost, but has only passed into a qualitatively different, yet quantitatively equivalent state of force, out of which it again emerges in some way or other. *In thus emerging, if it has changed, it has done nothing more than alter its form.* For Force may assume very varied forms in the Universe, but remains still essentially the same. These different forms can pass one into another, but, as already intimated, without loss and according to the fundamental law of equivalents or equal values, so that the total sum of energy present neither increases nor diminishes, and only the totals of the different forces are changed.

"The existing amount of Force" — says the author of an essay on the law of the Conservation of Energy in Westermann's "Unsere Tage" — "remains changeless. We can change its effects at our pleasure, but only qualitatively; in its quantity no increase nor diminution is in any fashion possible."

The science of Physics, or of the system of forces, of their changes and transmutations, makes us ac-

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quainted with seven or eight different forces, which in concert with matter and indivisibly united with it "form and build up the universe". These are: Gravitation or the general attraction between masses, including mechanical energy, Heat, Light, Electricity, Magnetism, Affinity or chemical relationship, Cohesion and Adhesion or molecular attraction, Molecular Force — among which are generally reckoned Weight, Cohesion and Affinity as well as the so-called latent or static energies, and the rest as dynamic energies or as atomic and molecular motion. These forces can be transmuted into one another almost without exception and in such a fashion that in the transmutation nothing is lost, but that the newly arising force is equivalent or equal to the original one and can perform new work as an independent energy. In the universe from which an inexhaustible store of energy comes to us, the forces are connected with the heavenly bodies, mostly under the forms of light and heat in the sun and the fixed stars; as mechanical energy in the planets revolving round their central orb, and as chemical difference, cohesion and magnetism in the ponderable materials of the bodies in the universe.

Of the change or the so-called *transmutation of energy* we here adduce some examples:

By combustion or combination of various chemical elements, light and heat are evolved. Heat may further be changed as steam into mechanical force, as for instance by being used in the steam-engine; and mechanical energy can again be reconverted into heat by friction, and in the magneto-electric machine it can be re-transmuted into Heat, Electricity, Light and chemical difference. One of the commonest trans-

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mutations of energy is that of heat into mechanical force and *vice versa*. If two pieces of wood are rubbed together, heat and fire are produced. On the other hand, if a steam-engine be heated, then heat in turn is transmuted into friction and motion. The change of heat into mechanical motion and *vice versa* may be most strikingly demonstrated by a railway train. The heat obtained by combustion in the engine changes into the movement of the carriages. But what happens when the train stops? Its mechanical energy cannot be destroyed, it can only be changed. The breaks are put on, and the train is thereby brought to a standstill, the motion being transmuted into heat, as is proved by the smoke and sparks caused by the friction.

While by the combustion of coal in the steam-engine, chemical action is transmuted into heat, which in its turn is transformed again into mechanical energy, so in reverse manner can we transmute mechanical energy into heat if we make it drive a wheel which works a massive wooden cone within a hollow metal one that fits closely round it. This becomes heated to such an extent that we can thus warm a room by means of the energy obtained from a waterfall, a river or a windmill.

In gunpowder, unsatisfied chemical affinities lie side by side. So soon as the igniting spark reaches it, the chemical differences are compensated, and heat, light and mechanical energy are given forth.

In the voltaic pile the chemical action between zinc and oxygen is transmuted into a current of electricity, and this may appear at the poles as heat and light, or again as chemical action in the voltameter.

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In the electric machine, the mechanical energy of the arms turning the disc, which itself results from an equalisation of chemical difference (respiration), is changed into electrical tension and current, and this can again appear, according to circumstances, as attraction (mechanical energy) or as light, heat and chemical action.

The English philosopher W. R. Grove has constructed an apparatus by means of which, using *light* as the original force, he can develop simultaneously *five* other forms of force, *viz.* chemical activity, electricity, magnetism, heat and motion. It may indeed be accepted as a law that when a certain energy is evolved from a body, all other energies also manifest themselves as active therein. If, for instance, antimonious sulphate is electrified, it becomes at the same time magnetic, warm, radiant (if the excitation is carried over a certain limit), moved by extension and chemically active by decomposition, so that *six* different forces thus become active. Similar phenomena are seen in the electrification of metals; it is only doubtful whether with them there is any chemical decomposition.

In all these processes of transmutation, the calculated amount of force spent on one side agrees most accurately with that which is spent on the other. By means of an electric current, for instance, water can be resolved into its constituents, hydrogen and oxygen, and so much of these two gases is set free that by their combustion exactly as much heat is evolved as forms the equivalent of the electric current which was transmuted.

In the impact of moving bodies, mechanical energy

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is generally changed into heat, as may be seen in the iron heated by the smith's hammer or in two inelastic balls (as of lead) impelled against each other, which become *heated* by the impact, whereas, on the other hand, two elastic bodies (as billiard balls) do not become heated because they utilise the mechanical force imparted to them in the rebound. Or, when a cannon-ball strikes the side of an armoured ship, a flash and a visible glow mark the spot struck, for the impact has changed the motion of the ball into intense heat, or the total motion has become heat. If two heavenly bodies were to rush against each other — an occurrence which must doubtless have often happened in the past, as it will yet happen — then a quantity of heat would be liberated by the shock, sufficient to reduce the total mass of those bodies to their original condition, *i. e.* to convert them into vapor.

Like impact, the mechanical force of pressure or condensation develops heat, as may easily be observed in the pneumatic tinder-box or in coining works. All molecules of a body, as they approach each other, set free the heat or energy which they before used in repulsion — whereby heat is evolved. It is thought, not improbably, that all the light and heat present in the universe arise from this source, and chiefly the most usual form in which energy is given forth, *viz.* the light and warmth of the central suns. All energies on this earth, whether in the organic or inorganic worlds, can and must directly or indirectly be derived from the beams of the sun. The flowing water, the driving wind, the passing clouds, the rolling thunder and the flashing lightning, the falling rain, snow, dew, frost

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or hail, the growth of plants, the warmth and motion of animal and human bodies, the combustion of wood, of coal etc. etc. may be referred without argument to the sun. By burning wood or coal, the total amount of the vanished sunshine laid up in these substances may again be evolved. The force which urges forward the locomotive, is a ray of sunshine converted into work by a machine, just the same as the work which creates thoughts in the brain of the thinker, or forges nails by the arm of the smith.*)

The tremendous force with which the tunnel of Mont Cenis or of St. Gothard was driven through the highest mountains, is nothing more than solar heat converted into mechanical motion. "The heat

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*) In 1857, Mr. Murray, of London published a biography of the famous English engineer George Stephenson, born 1781, died 1848, by Smiles, from which we take the following interesting account: "On Sunday, just when the company had returned from church and were standing on the terrace overlooking the railway station (Drayton), a train rushed by, leaving a long line of white steam behind. 'Now', said Stephenson to Buckland, the well-known theological geologist, 'can you tell me what power moves that train?' — 'Why', replied the other, 'I suppose it is one of your big engines.' — 'But what moves the engine?' — 'O, probably one of your stout Newcastle engine-drivers.' — 'What do you say to the light of the sun?' — 'What do you mean?' — 'Nothing else moves the engine', said the great engineer, 'it is light which for thousands of years has accumulated in the earth — light which was inhaled by plants, that these during the time of their growth might fix the carbon, and which now, after having for thousands of years been buried in the coal-beds of the earth, is again brought forth and set free, to serve the great purposes of mankind, as here in this engine.'" Assuredly a most remarkable utterance, considering the time in which it was made, and one instantaneously illumining a new field of science.

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wherewith we warm our dwellings," says Liebig, "is sun-heat, the light wherewith we turn night into day is light borrowed from the sun." The light which is sent by suns to the non-transparent planets illuminated by them, does not perish on these, but is converted into heat, while, on the other hand, increased heat appears as light from the heated bodies, as may be easily observed by heating a bar of iron above a certain temperature.

Magnetism can be manifested in the magneto-electric machine as an electric current, and this again in various other forms.

Gravitation appears directly as mechanical energy and can then as such be converted into all the forms already mentioned. In every pendulum clock it can be seen that weight not only can be changed into motion, but also into heat, since the parts of the clock are warmed by the friction.

Under such circumstances a given amount of energy is seldom completely and perfectly changed into another, but a part of it is either transmuted into other energies and is consequently not observed, or it is not transmuted at all. In the steam-engine, for instance, a large, indeed by far the greatest part of the heat produced is not changed into mechanical force, but emerges as heat with the escaping vapors or the condensation water or by the cooling of the parts of the machinery. In the fire-arm it appears as if a part of the mechanical energy were lost; but it is only *apparently* lost as to the effect or intended object, because, in the first place, it warms the gun-barrel, and secondly is changed into the report. In similar fashion in an electric machine a part of the

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force is lost by being imparted as heat to the disc, the rubbers etc. The word "lost" is, however, a misleading one, for in all these and similar cases not the smallest quantity of force is absolutely lost or lost to the universe, but is only lost to the immediate object and therefore seems to have vanished from the superficial glance. In reality the excited energy has only taken a different shape, the amount of which must be equal to that of the former. In general, all forms of force and motion can be *completely* and *without loss* transmuted into *heat,* while heat in each case can only be *partially* changed into the other modes. The examples by which this truth may be particularly demonstrated are countless in Nature; they may all be summed up in the proposition: *Force can be neither created nor destroyed* — a proposition from which follows the indestructibility of force and the impossibility of its having as such either a beginning or an end. The result deduced from this newly discovered physical truth is the same as that deduced from the indestructibility of matter; the twain together have built up from eternity and will build up for evermore that totality of phenomena which we call the *Universe.* The "circulation of force" must be placed side by side with the "circulation of matter" as its necessary corollary and its necessary completion, and it teaches us that nothing originates and nothing perishes, and that the secret of Nature lies in an eternal self-sustained circle, wherein cause and effect are united without beginning and without end. That only can be eternal which has been from eternity, and that which is eternal, cannot be created or made.

"Everywhere is change, nowhere is annihilation.

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In the organic as well as in the physical world, in living as well as in dead bodies, there is everlasting motion. Absolute repose is found nowhere. All is changing, and from the mould of the dust new life arises unceasingly." (Tyndall.)

In judging this newly discovered physical truth and its consequences, it is certainly very interesting to find that *Voltaire*, known to be bitterly opposed to the teaching of his materialistic countrymen and contemporaries, required nothing further from them to convince him than exactly *this* proof of the conservation of the energies of Nature. "The materialists," he says in his 'Traité de Mataphysique,' chap. II, "must maintain that motion is inseparable from matter. They are therefore further compelled to maintain that motion can never be increased or diminished; they must assert that a hundred thousand men set in motion and a hundred cannons fired at one time, introduce no new motion into Nature." This fact, which *Voltaire* held to be so impossible that he thereby thought to demonstrate the emptiness of the materialistic views, *is to-day completely proved.* How many similar arguments opposed to so-called Materialism will meet with a similar fate in days to come!*)

*) Further details on the law of the conservation of energy and on the "circulation of force" derived therefrom, as well as on the history of its discovery may be found by the reader in the author's work "Licht und Leben," (Leipzig 1882) in the second essay, "Der Kreislauf der Kräfte und der Weltuntergang." In the first essay on "Die Sonne und ihren Einfluss auf das Leben" will be found the fact proved by many experimental investigations, that the beams of light and heat given out by the sun are the sole and final cause of all motion on the earth and of all earthly force-activities in the organic as well as in the inorganic world.

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INFINITY OF MATTER.

"Hence we recognise that it will never be possible to decide the dimensions of the final particles of matter; our ideas are shut in between two infinities, between the infinite vastness of planetary space and the infinite minuteness of molecular structure."

Secchi.

"Indeed the conception of the infinitely minute is as little capable of being grasped by us as is that of the infinitely great. Despite this the admission of the reality of the infinitude both in the direction of greatness and of minuteness is inevitable."

Dr. C. Jakob.

"The idea of space is only an unavoidable illusion of our Consciousness or of our finite nature and does not exist outside ourselves; the universe is infinitely small and infinitely great."

Radenhausen.

As matter is endless in time or eternal, so it is no less without beginning or end in space; in its real existence it withdraws itself from the limitations imposed on our finite mind by the conceptions of time and space, conceptions from which it cannot free itself in thought. Whether we enquire about or investigate the extension of matter in the minutest or the greatest, we nowhere find an end or a final form, whether we call to our aid experiment or reflexion. When the discovery of the microscope or the juxta-

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position of magnifying glasses, opened up worlds unknown before, and revealed to the gaze of the investigator a fineness and minuteness of organic life and organic form-elements undreamed of until then, man cherished the audacious hope of coming on the track of the final organic element, perhaps on the very basis of existence. This hope disappeared in proportion to the improvement of our instruments. In the hundredth part of a drop of water was found a world of little animals, often of the daintiest and prettiest form, which moved, ate, digested, lived like every other animal, and by the fashion of their movements left no doubt that they were not without the two chief marks of animal life, sensation and will. The smallest of these under the highest magnifying power are barely recognisable as to their outlines; their internal organisation naturally remains wholly unknown to us. It is also unknown to us, what yet smaller forms of living things can or may exist. "Shall we", asks Cotta, "with yet improved instruments see the Monads as giants in a dwarf-world of still smaller organisms."

The remarkable wheel-animalcule, formerly mistakenly classed among the Infusoria, which measures from 1—120th to 1—240th of an inch, has a gullet, toothed jaws, stomach, intestine, glands, ovaries, eyes, blood, vessels and nerves. A drop of sea-water contains a crowd of the most various and most curious forms, as balls, crosses, baskets, screws, stars, chess-like figures, horns, caps, helmets etc., and each of these forms represents a perfectly developed independent living creature, endued with sensation and power of movement.

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The swift Monad (Flagellata) measures the twenty-four-thousandth part of an inch, and several millions of these may be found in a drop of liquid. The vibriones, microscopic animals of the minutest kind, appear under magnification as heaps of tiny quivering, scarcely perceptible points or threads, sometimes straight, sometimes twisted like a corkscrew, and of these it is calculated that more than four thousand millions would occupy a cubic line. As to their near allies the bacteria, the so-called protista or original life-forms, which stand midway as to their nature between the plant and animal kingdoms, or the rod-like bodies which move quickly through the water by means of a fine and often scarcely visible vibrating flagellum and have lately been recognised as most dangerous vehicles of disease — of these, according to Prof. Cohn's calculation, 663 millions go to a cubic millimetre, and 636,000 millions would be required to balance the weight of a gramme or the five hundredth of a pound. The spores of a fungus discovered on the vine in Italy are so small that a human blood-corpuscle looks like a giant beside them under the microscope; but the blood-corpuscle is itself so minute that the smallest drop of blood, a cubic-millimetre in size, contains more than five millions of them. The Ascaris (a round worm) lays about 64 millions of eggs, and almost as many ovules are produced by a single orchid. In all these minute bodies resides the organic energy of transmission or the tendency of the reproduction of a being resembling the parental form in all its finest peculiarities — a specially complicated collocation of the material elements of which we can form no conception, for our power of vision

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here comes to an end. Still less is the microscope able to give us any explanation as to the wonderful arrangement and internal conditions of animal or human seed, in which a single cell of microscopic minuteness is able to determine the physical and mental nature or characteristics of a future being, often to the finest shades during the course of a whole life.

Still all these bodies or objects, minute as they may be, are yet visible to our enlarged eyesight. But when we come to the newly discovered method of *spectrum analysis* and find it capable of revealing with certainty the presence of the third part of the thousand millionth part of a gramme — five hundred grammes to a pound — of a heavy body (as for example kitchen-salt) in the air of a room, we have here a particle which lies outside the limits of our direct perception, even though we should largely increase the magnifying power of our microscopes. None the less must it be presumed that this particle is in turn composed of an indefinite number of atoms and molecules grouped together, and that the interspaces which separate these minutest particles of matter from each other, must be as wide, as enormously great in comparison to their size as the interspaces which separate from each other the individual worlds. "The most powerful microscope", says Professor *Valentin*, "will never bring within our view either the form or the position of the molecules nor even those of the smaller groups of atoms. A grain of salt which we can scarcely taste, contains myriads of atom-groups, which no human eye will ever see." The English philosopher, Professor *Thompson*, has sought to deter-

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mine the size of a zinc-molecule at the thirty-millionth part of a millimetre, and in this it must not be forgotten that the molecule may, and indeed must, be very large as compared with an atom; while the diameter of a blood-corpuscle is reckoned to be only 1—3600th part of an inch, and that of the smallest Infusoria the fifteen-hundredth of a millimetre. But then, this number is merely the extremest limit of what we are able to compute on the ground of ascertained data. The same scientist has calculated that if a drop of water could be expanded to the circumference of the globe, which has a diameter of 8000 miles, and if each single water molecule were expanded to the same relative size, then each of these molecules or distinct water particles, which are composed in their turn of atoms of hydrogen and oxygen, would only be about the size of a bullet! Professor *Perty* (Die Natur, 1869) communicates a calculation according to which a cubic line of organised substance must contain about 240,000 billions of elementary atoms! But all this is far surpassed by the calculations which have lately been made by English and German scientists upon the molecular constitution of the lightest bodies known to us, *viz.* the gases. The so-called kinetic theory of gases, set up by *Clausius* and *Maxwell*, puts the number of molecules (the groups of atoms, atomic systems) in a cubic-centimetre of gas or vapor at no less than *twenty-one trillions*, their relative distances from each other being from a three-millionth to a four-millionth of a millimetre; and that 144 trillion molecules of the pure hydrogen gas weigh a milligramme (the thousandth part of a gramme). According to *Carus*

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Sterne there are *six trillion* molecules in a thimbleful of gas — a number of which Prof. *Kundt* endeavours to give an idea as follows: "If a printing-press were able to print every day a lexicon containing three million letters, it would then have to work continually for 64,000 years in order to print as many letters as there are contained molecules in a thimbleful of air." And it must not be forgotten that the individual molecules do not lie closely one on the other, but are so widely separated in consequence of their so-called "molecular spherules", that according to *Clausius* they in reality occupy only the three-thousandth part of the entire space. The velocity with which these molecules vibrate among each other has been reckoned at 1698 metres per second for the lightest gas, hydrogen; while those of the heavier gases vibrate with a similar relative velocity, but still appreciably slower. In a medium velocity of 477 metres the number of repulsions between the molecules is reckoned at 4700 millions per second. The ingenious English scientist *Crookes*, as is well known, has reduced enclosed gases by mechanical and chemical methods to such a state of rarefaction that he obtained the remarkable phenomena of "radiant matter" or the so-called "fourth state of aggregation of matter", wherein the freer or unconstrained molecules move among themselves more easily and more swiftly. These phenomena prove that it was a great error to suppose that by such rarefaction could be obtained a vacuum or space emptied of air or even a condition of matter approaching thereto. For example, suppose a globe or a space from 13 to 14 centimetres in diameter, which according to the best

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authorities should contain about a quadrillion gas-molecules, exhausted to the millionth of an atmosphere, yet according to Dr. *Kalischer* (Journ. "Natur" 1880, Nos. 17 and 18) *there will still remain in it a trillion molecules!* In order to give an idea of this vast number, the same writer makes the following calculation: If in such an exhausted globe a hole could be made of such minuteness that in each second a hundred million gas-molecules could enter through it, then must about 400 million years pass away before the globe would again contain air of the original density of the atmosphere, or would again contain a quadrillion gas-molecules!

We may learn the incredible rarefaction or extension of which matter is capable, as the resultant of its molecular or atomic groupings, by a glance at the calculations which have been made on the inconceivable rarity of ether — a substance, imponderable by the mechanical means at our disposal, which fills all planetary space as well as the finest interspaces within all bodies; and also by those made on the density of certain celestial bodies, or on the original vaporous condition of our own solar system. Imagine the total mass or ponderable matter of our planetary system, including the sun, distributed over a ball which has for its circumference the orbit of Neptune, the outermost planet known to us — and the vaporous ball from which the system evolved must have had such an extension and very probably a much greater one — then the matter composing it would be so rare that the density of that primal mist would be only the 553 millionth part of that of our atmosphere; according to *Radenhausen* it would have one ten-millionth

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of the density of hydrogen, the lightest of all terrestrial bodies; and according to *Helmholtz*, a single grain of solid earthly substance would, if made equally rare, fill many million cubic miles. If we believe with many astronomers that the primal sphere of our solar system had in reality a radius of two billion miles, then the density of that primal matter could only have been the 600,000 billionth part of the density of hydrogen, whilst at the period that the ring of the earth-planet severed itself from the solar orb it must have already attained a density equal to the nine-hundredth part of that of hydrogen gas!!

Cometic matter or the matter of which are composed these remarkable knights-errant of the universe, is, according to the calculations of astronomers, so fine or rare, that a cubic mile of it would scarcely weigh a few grammes, or borrowing the astronomer *W. Meyer's* phrase, the comets, if compared with the planets relatively to their mass, are scarcely as a paper snip compared with a cannon-ball. Light and fluid, however, as are these erroneously dreaded skyvisitants, yet the ether — that excessively rare, to us imponderable substance, which according to the views of physicists not only fills the realms of space but fills also the tiniest interspaces of even the densest bodies, and which passes through glass walls and unceasingly flows around all atoms and molecules — this ether offers to the passage of the comets a resistance comparatively so slight, that its lightness or rarity far surpasses that of everything else that is known, and that we hesitate to state the figures, because they sound too audacious.*)

*) Later physicists deny the existence of the ether and ac-

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An atom (from the Greek α and τέμνω, *i. e.* a thing which cannot be divided) is the name we give to the smallest portion of a chemical element or elemental matter, which we regard as capable of no further division, or the division of which we cannot conceive; and we regard all materials or bodies as built up out of such atoms or out of groups of two or more of such constituting a common body, the so-called molecules, and existing and maintaining their characteristics by a changing system of mutual attraction and repulsion.

Perhaps we are not mistaken if we regard a molecule as somewhat resembling in miniature the systems of the universe and compare the separate atoms, out of which it is built up, to the separate

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cept in its stead an excessively rare gas or rarefaction of ordinary matter. According to Secchi it consists perhaps of none but the primitive or true atoms of the unknown primal matter, from which were built up in separate sets or groups those we erroneously name elements or original matter, so that all forms of matter would thus be constituted from ether. According to *Spiller* (Die Urkraft des Weltalls 1876 — a book well worthy of study) the ether, as the universal force-endued matter, the one primal energy of the universe or the soul of the world, is the universe-will or the energy-matter, the unwearied architect to whom all atoms must yield obedience without volition, and "which without personality or self-consciousness dictates all natural laws from the gravitation of the greatest and most distant worlds to the chemical action of the body-forming and to us invisible atoms of matter". He calls his system Etherism or the system of universal ether. If the theory be accurate, that the matter filling the interplanetary spaces is only the remains of the former primal vapor, then it must be far rarer than it was originally, since the materials have been taken out of it for the making of the solid bodies evolved therefrom.

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celestial bodies joined sometimes in pairs, sometimes in a system. But suggestive as is such an image, and appropriate as it seems to throw a welcome light upon a large number of chemical and physical problems, on the phenomena, properties and activities of matter, we must yet admit that the word "atom" is only a name for an artificial idea resulting from the craving of our mind for limits in space, and which we require for the sake of scientific objects. The science of chemistry especially seems impossible without atomicity, and every theory or concrete representation in it must be at an end without this. But yet atomicity is and remains a scientific hypothesis, and we are wholly without any real grasp of the thing that we call an atom. We know nothing of its size, its weight, its form, character, color, etc.; we know not if it is elastic or fusible, if it is angular or spherical, etc.; although speculations as to the shape and properties of atoms have not been wanting. No one has seen the atom, and no one will ever see it; speculative philosophers deny its existence because they cannot admit that a thing can exist, the division of which cannot be imagined, and they declare that it is impossible both logically and empirically. In fact the unlimited divisibility of atoms or of the molecules built up from them can be doubted when looked at either from a theoretical, a metaphysical, or an empirical point of view, and it can only be maintained that we are not in a position to divide them further by the chemical and physical forces known to us. If for instance chemistry teaches that a molecule of quicksilver is a hundred times as heavy as a molecule of hydrogen, then must the former in

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comparison with the latter have a comparatively large size and hence must be divisible. It has also become very probable through recent investigations that the substances heretofore regarded by us as elements or original bodies are nothing of the kind, but are themselves compounds, and that the so-called atoms therefore consist of units of a higher grade, as the molecule does of atoms. Hence we must regard the atom, if we desire to retain this idea, as being physically the type of the infinitely small.*)

Thus neither by observation nor by thought can we, in contemplating matter in minuteness, reach a point at which we can stop, and there is no likelihood of such a point being reached. "Everywhere we find", says Stewart, "that the limitations of our reasoning faculties in respect of space and time shut out the possibility of our becoming accurately acquainted with these exceedingly minute bodies, which are none the less the raw material out of which the universe is built up." On the other side of

*) Atomicity, or the explanation of the whole by the parts, was founded by the Greek philosopher *Leukippus* (500 B. C.) and developed by his disciples *Democritus*, *Epikurus* and *Lucretius*. Expelled from general knowledge by Christianity and from science by the Socratic philosophy, it was resuscitated and brought out again by *Gassendi*, *Hobbes*, *Dalton* and others (1592—1844), while *Lavoisier*, towards the end of the last century, proved the indestructibility of the atom and founded thereupon modern chemistry. A modern speculative natural philosophy, somewhat fantastic in its methods, seeks to throw doubt upon the material existence of atoms and to regard them as centres of energy. Particulars of this, as well as of the criticism of the Atomic Theory, will be found in the author's work "Natur und Geist," 3rd. edition, p. 79, *et seq.*

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the present outposts of microscopical investigation the famous English scientist *Tyndall,* on the occasion of a meeting in the Philharmonic Hall, London, suggested a yet unmeasured field of scientific imagination. For we have here to deal with bodies so infinitely small, that in comparison with them the test-objects of the microscope are literally immeasurable. "As the distances in space of the planetary realms merely give us a dizzy notion of immeasurability, without leaving any definite impress on the mind, so the quantities with which we have to deal here, leave with us a dizzy feeling as to the minute."

Hence we can say nothing except that matter and therefore the universe are infinite in minuteness, and it matters little if our reason, accustomed to find quantity and limit everywhere, should be startled by such an idea. —

As the microscope guides us in the world of the minute, so does the telescope direct us in the world of the vast. Here also astronomers audaciously dreamed of penetrating to the very limits of the universe, but the more they perfected their instruments, the more immeasurably did the worlds expand before their astonished gaze. The light white mists seen by the naked eye in the vault of heaven were resolved by the telescope into myriads of stars, of worlds, of suns, of planetary systems; and the earth with its inhabitants, so fondly and proudly deemed the very crown and centre of existence, fell from its fancied exaltation to a mere atom moving in immeasurable space. "All our experiments yield us not the slightest trace of a limit; each increased power of the telescope only opens to our gaze new realms of stars

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and nebulæ, which, if not consisting of galaxies of stars, are self-illumining matter." (Grove) "With each sharpening of our tools which bear our gaze into the waves of light of the furthest starry realms, new waves of suns break forth from the limitless ocean of the stars." (W. Meyer) "Even with the most powerful telescopes we see so many faintly-shining stars that we are unable to doubt that on the further side of these there are yet others which will become visible by larger instruments." (G. J. Klein) "From all these experiments we conclude that the depth of celestial space cannot be sounded, and that we shall never succeed in reaching its bounds. We should vainly strive by a cumulation of resemblances to give even an approximate idea of the immeasurableness of the starry universe." (Secchi)

The distances calculated by astronomers in space are so vast that our intellect grows dizzy as we contemplate them, and our fancy tries in vain to follow the conceptions suggested by them. Seeing that even the distances in our own solar system cannot be realised by our minds, how much less can those of the fixed stars, which are generally designated by the so-called "solar distances" (20 million German miles or 148·6 million kilometres) or by the time taken by light to travel across them. Thus in order to find a mathematical expression for the enormous distances in space, astronomers have adopted the so-called *light-time*, based on the extraordinary velocity of light, which, as is well known, travels at the rate of 40,160 German miles per second (186,000 English miles *Tr.*). A second of light-time therefore means a distance of 186,000 miles; a year of light-time means nearly six

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billion miles (5,865,696,000,000). Now the distance of the fixed star nearest to us (α Centauri), the sun nearest to us outside our solar system (one of the brightest of the stars), is reckoned at about 3¾ years of light-time, or at 224,500 solar distances, or nearly 22 billion miles (21,996,360,000,000); the distance of the star 61 Cygni is about 400,000 solar distances, or 37 billion miles, or nearly 60 billion kilometers. The distance of the brilliant Sirius or of the dog-star of Aquarius from the earth is calculated at 17 light-years, or at more than a million times the distance of the earth from the sun. If we wanted to travel from the earth to the nearest fixed star we should require 30,000 years for our journey — supposing that we were able to move towards it in a straight line with the velocity of our solar system in space (18¾ miles per second), and that it did not change its position. But the above-named stars all belong to those lying near to us, whereas the distant fixed stars are reckoned at a distance of hundreds and thousands of light-years. The number of these stars, or rather suns, lying outside our system, has been raised by the giant-telescopes of late years to about twenty millions, whereas we can see only some 4000 or 5000 of them with the naked eye; and these countless suns are divided from each other by such spaces as we have above described, including the yet more countless satellites and sub-satellites which probably accompany them. But all these taken together do not form the universe; on the contrary, they one and all belong to a definite and comparatively much limited star-system, beside which there are countless others and mostly larger systems in the

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universe. This system, or republik of stars, of which our sun with its satellites only forms a small part, or this island of worlds stretches in form like a somewhat strongly flattened lens through space, and is bounded at its periphery by two almost parallel annular aggregations of suns, which are visible to us in the form of the well-known *via lactea.* The distance of these from the earth is calculated at from 4000 to 5000 light-years, that is to say, light would require this time to travel thence to us, while according to *Mädler's* calculation it requires 9000 years to travel round the ring of the milky way from one end to the other. Our sun, which is not quite in the centre of this system of fixed stars, but stands on one side, is 573 light-years from the centre of this ring and lies about a thousand light-years nearer to one side of the inner milky way than to the other. The whole system most probably revolves round a common and yet undiscovered fixed point or virtual centre.

But even this is not enough; the telescope informs us that this system with all its countless hosts of stars, with its distances and extensions escaping from our grasp, is yet but a finite limited part of the immeasurable universe, and that at distances, in comparison with which all the bewildering dimensions of the ring of the milky way are infinitely small, there exist other world systems which lead their existence quite independently of ours. These are the so-called nebulæ, those wondrous forms in the deepest depths of space, whose position, shape and condition shew all imaginable variety, and of which, since *W. Herschel* first intimately observed them, considerably more than 6000 are known at present.

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Part of them by far exceed in their extension — although they often appear to the eye as mere shining dots and sometimes cannot be seen without the greatest difficulty — that of the milky way, and they like the latter must either consist of many millions and thousands of millions of celestial bodies or of planetary systems coming into existence. Their distances from us are so fabulous that they can only be reckoned by millions of years of light-time; nay, some even are said to have been observed which must be at a distance of a hundred million years of light-time. These are indeed merely phrases, with which we are unable to connect any idea, for we have no sort of terrestrial measure for them; only the word "infinite" is and remains applicable here. "The universe", forcibly remarks the French philosopher *Pascal*, "is a circle whose centre is everywhere and whose circumference is nowhere."

If from these facts it is sought to draw any conclusion as to the antiquity of the world, it then cannot be doubted that the present order of the celestial bodies, that which we call in the widest sense the "order of the universe," must have existed for millions of years in the same or in similar order to that we find to-day. In fact as we gaze at the firmament, we read thereon only the circumstances, the record of past minutes and hours or of times lying far behind us, and occurrences which perhaps took place before our earth separated itself as an independent body from the solar sphere, appear to us as present. When we observe a change in the sun, we can only say that such a change took place seven and a half minutes ago, for the light requires that

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time to travel from it to the earth. If Neptune, the most distant planet of our system, were destroyed by any catastrophe, it would only vanish from our sight 4 or 5 hours later, for that is its distance from us reckoned by "light-time." If the beautiful star *Vega* in the constellation of the Lyre were suddenly to cease to exist, we should none the less behold it shining in the sky for eighteen years to come, for the rays of light that strike our eyes in witness of its existence quitted it eighteen years before. But the stars whose light is visible to us by the aid of our best telescopes are calculated to be at a distance of from 2000 to 3000 years of light-time, that is that the dying ray, which brings us the tidings of their existence, left its source about the time that Homer sang on our earth, or the great sages of Greece lived and taught. And when perhaps a hundred million years ago the first and earliest forms of life began to germinate on the young earth, then sprang from yonder furthest nebulæ the ray of light which sinks to-day into our eyes as the witness of their existence! "Yes, there can be no doubt that there are stars which give us no light simply because their rays have not yet reached our earth, and others again that lie so far away that their rays can no longer reach the globe, either because they have already ceased to exist or because the illuminating power of the ray cannot traverse the enormous distance." (Dü Prel)

But that even *these* stars do not and cannot signify the limits of the world-filled realms of space can be deduced from the law of gravitation as well as from analogy. Empty, boundless space is an astronomical as it is a logical absurdity. "To suppose" says Grove

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(Correlation of Phys. Forces, 6th. ed. p. 125) "the stellar universe to be bounded by infinite space or by infinite chaos, that is to say, to suppose a spot — for it would then become so — of matter in definite forms, with definite forces, and probably teeming with definite organic beings, plunged in a universe of nothing, is, to my mind at least, far more unphilosophical than to suppose a boundless universe of matter existing in forms and actions more or less analogous to those which, as far as our examination goes, pervade space." —

If then we can find no limit to matter in the minute, still less are we able to find a limit in the vast; we must therefore pronounce matter to be infinite in both directions, in the great as in the small, and to be independent of the limitations of space and time. If the laws of thought postulate an infinite divisibility of matter, if, according to them, it be also impossible to imagine a limit to space and *nil* beyond it, we find a remarkable and satisfying unanimity between the laws of logic and the results of our scientific investigations. We shall hereafter have an opportunity of proving the identity of the laws of thought with the mechanical laws of external nature on other points as well, and to shew that the former are the necessary product of the latter.

"Beyond the range of human reason", says *Radenhausen* in his 'Isis', vol. IV, p. 172, "there is neither space nor time; they are arbitrary conceptions of man at which he has arrived by the comparison and arrangement of different impressions which he has received from the outside world. The conception of space arises from the sequence of the various forms which fill space, by which the external world appears to

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the individual man. The conception of time arises from the sequence of the various forms which change in space (motion), by which the external world acts on the individual man, and so on. But externally to ourselves the distinction between repletion of space and mutation of space does not exist, for each is in constant transmutation, whatever is is filling and changing at the same time, nothing is at a standstill" etc.

"Weder Anfang hat die Welt, noch Ende,
Nicht im Raum, noch in der Zeit.
Ueberall ist Mittelpunkt und Wende
Und im Nu die Ewigkeit."

("The world has neither beginning nor end, in space nor in time. Everywhere is centre and turning-point, and in a moment is eternity.") Rückert.*)

*) Further details on the conceptions of space and time, as also on the laws of reason as a law of nature may be found in the author's works, "Natur und Geist," pp. 159 *et seq.*, and "Die Macht der Vererbung" (Leipzig, 1882), pp. 91—93.

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VALUE OF MATTER.

"By an intellectual necessity I cross the boundary of the experimental evidence, and discern in that Matter which we, in our ignorance of its latent powers, and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobrium, the promise and potency of all terrestrial life."

Tyndall.

"The times are gone by in which man dreamed of spirit independent of matter. But the times are also past in which the spiritual was supposed to be degraded if it was only manifested through matter."

Moleschott.

"Men have constantly endeavored to degrade matter, but have only succeeded in shewing that the divine beauty of a fundamental constituent of their nature is hidden from them."

Elements of social science.

There was a time when men, in a frame of mind hostile to earth and seized with a sort of mental and moral crapulence over the destruction of this present world, imagined that they saw approaching the end and ruin not only of political but also of all earthly things. In this mood they turned in thought to the wonders and delights of that other non-earthly world, which should recompense them for the intolerable

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tribulation of the present one. Hence arose, or at least found wider acceptance, that foolish conception which matter looks upon as a crude, dismal, inert Something, hostile or opposed to spirit; it received support from the then ruling philosophy of Aristotle, which also regarded matter as incapable of independent motion and therefore as dependent on a moving reason (νοῦς). Thus religious fanatics began to vent their rage against their own bodies, which were regarded as the chief obstacle to the higher mental or moral impulse. The earth was looked on as a vale of tears, Nature as a thing subject to the curse of the deity; man's own flesh was the most contemptible of all and was to be injured and punished as much as possible. Had not the apostle Paul, the real founder of the new universal religion, expressly declared: "They that are Christ's have crucified the flesh, with its affections and lusts."

"This whole island (Capraria)" says an ancient Roman historian at the time that Christianity was imported into a world doomed to destruction and hastening to its fall, "is occupied or rather disfigured by men who shun the day. They call themselves *monks* or hermits, because they live alone and wish to have no witnesses of their actions. They avoid the gifts of fortune lest they should lose them; and in order not to become unfortunate, they devote themselves to a state of voluntary destitution. How absurd is their choice! how preposterous their reason! to fear the evils of human conditions without being in a position to enjoy its pleasures! This melancholy insanity must be the result of a disease, or else the consciousness of guilt drives these unhappy men to rage against their

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own bodies, upon which they inflict torments such as are assigned by the hand of justice to runaway slaves." *)

In the Middle-Ages, that desolate period of rude noble tyranny and fanatical priestly dominion, so-called servants of God had carried things so far that matter was treated with consistent contempt and that they nailed their own bodies, the noble work of Nature, to the pillory. Some crucified themselves, others tormented themselves; crowds of flagellants or self-floggers wandered through the country, openly exhibiting their voluntarily torn bodies; men strove by refined methods to ruin health and strength, in order that the spirit — regarded as something supernatural, as something independent of matter — might gain the victory over its sinful bearer. The saintly *Ber-*

*) Compare the famous "Decline and Fall of the Roman Empire" of Gibbon, who, writing on the monks and monasteries of that period, adds: "The freedom of the mind, the source of every generous and rational sentiment, was destroyed by the habits of credulity and submission; and the monk, contracting the vices of a slave, devoutly followed the faith and passions of his ecclesiastical tyrant. The peace of the Eastern church was invaded by a swarm of fanatics, incapable of fear, or reason, or humanity; and the Imperial troops acknowledged, without shame, that they were much less apprehensive of an encounter with the fiercest Barbarians." And again: "They aspired to reduce themselves to the rude and miserable state in which the human brute is scarcely distinguished above his kindred animals; and a numerous sect of Anachorets derived their name from their humble practice of grazing in the fields of Mesopotamia with the common herd." He also quotes with regard to the effect of the monasteries on the empire the characteristic remark of Zosimus, "that for the benefit of the poor, the Christian monks had reduced a great part of mankind to a state of beggary." (See chap. XXXVII, Gibbon, for further details. *Tr.*)

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nard, as *Feuerbach* relates, so lost his sense of taste by excessive asceticism, that he ate grease for butter, and drank oil for water. *Rostan* tells us that in many monasteries the superiors were in the habit of bleeding their monks several times a year, in order to subdue the rebellious passions which the divine service by itself was incapable of containing. But he also informs us that nature trampled upon sometimes avenged herself, and that in these living graves revolts were not uncommon, when the superiors would be threatened with poison and dagger. It has long been known what sad and wretched ascetics are still found among the poor people of India. The consequence is that their glorious land is a prey and they themselves have become the slaves of a small number of aliens.

Such errors and perversions of right feeling are fortunately only possible at this day as generally condemned exceptions, or as follies committed by individuals instigated by fanaticism or insanity. A nobler view has shewn us that, as *Schleicher* says, neither spirit nor matter exists in the sense that is generally supposed, but that there is only one which is equivalent to the twain, and that as we degrade matter, we in the same proportion degrade the spirit; that as we dishonor nature, we injure the universal womb which has conceived and brought forth all of us; that as we ill-use our body we ill-use our spirit, and that he who acts thus injures himself to just the extent that he in his foolish fancy imagined that he had benefited his soul. Let us form and cultivate our bodies or what is matter in us not less than our spirit, and let us not forget that the twain are inseparable, and that what we do to the

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one, the other also benefits by. The old Ciceronian saying: *Mens sana in corpore sano* (healthy mind in healthy body) contains as much truth as its opposite: The mind builds its own body. On the other hand we ought not to forget that as individuals, as separate entities, we are only a fugitive part of the whole, which must sooner or later return into that whole. Nature, or matter in its totality, is the universal mother, evolving everything from herself and having everything restored to herself.

Ist denn nicht, was ihr Materie nennt,
Der Welt urkräftig Element,
Aus dem, was immer lebt und webt,
Empor zu Licht und Bewegung strebt,
Und das dich selbst und die ganze Welt
Im unergründlichen Schoosse hält
Und Alles gebiert und Alles verschlingt,
Was hier nach Leben und Dasein ringt?

(All that is called matter is the primal forceful element of the universe, out of which all that lives and moves struggles upwards to light and movement, which contains itself and the universe in its unfathomable womb, which brings forth and devours up everything that here wrestles for life and being.)

No nation knew better than the Greeks how to honor the purely human on its own account, and none knew better how to esteem life in contrast with death. Lucian relates: "When Dæmonax, a greybeard of one hundred years, was asked before his death how he desired to be buried, he answered: 'Do not trouble yourselves, the corpse will be buried by the smell.' — 'But' said his friends, 'would you then serve as food to dogs and birds?' — 'Why not?' he answered,

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'so long as I have lived I have striven to serve men with all my power, and why should I not give somewhat to the brutes after my death?'"

Our modern society can certainly not raise itself to this point of view. It is thought grander to barricade the pitiful corps with flagstones for a century, or to shut it up in the family vault with beringed fingers, rather than to restore to the Whole that which has been received therefrom and which cannot be withheld in perpetuity.

A medical theologian, Professor *Leupoldt* of Erlangen, maintains that those who from scientific reasons start from matter instead of from God, must really renounce all scientific ideas, because beings who are themselves only minute portions of nature and particles of matter, are incapable of penetrating into or of conceiving nature and matter. This reasoning is truly more worthy of the theologian than of the physician! Have those who start from God and not from matter, ever been able to give us any intelligence about the laws of nature or about the properties and activities of this matter which they regard so contemptuously? Could they tell us whether the sun moves or stands still? Whether the earth is round or flat? What is God's nature, or design? and so on. Can they give us the smallest scientific information on those great questions which are agitating the mind of every thoughtful person, as to the origin of the world and of man? or as to the laws by which, according to them, the universe is governed? No! that were an impossibility. "To start from God in the study and investigation of nature" is a phrase without thought or reason, which signifies nothing and by which nothing is got. That melancholy method

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of investigating nature, of philosophically contemplating nature, which starting from theoretical premisses or metaphysical ideas, fancied that the universe could be constructed and the truths of nature ascertained by speculative methods, has fortunately been overthrown many a long day; and exactly the opposite plan, the investigation of natural laws and natural phenomena by the deepest study of nature herself and by the enquiry into material facts and laws has yielded all those great results and beneficial effects in which we now rejoice both in spiritual and material respects.*) Then why should those who proceed from matter, or who base thereon their investigations, be unable to understand matter? On the contrary, we shall be able all the better to understand it and to control it, the more we endeavour to learn to know it in its infinite fineness and its incredible energy and capacity, by means of observation, of investigation, of experiment. Experience has spoken here with sufficient clearness. The scientists unfairly decried as "Materialists" have not only made it possible for our mind to penetrate by thought into the All and to obtain scientific certitude on questions and things which appeared for ever sealed to it; but we also owe it to them that the human race is more and more borne upwards in the mighty arms of matter, known and controlled through its laws, and that we can perform by it works and acts, which in former times seemed possible only to giants and magicians. Such results

*) Bacon of Verulam, the famous experimental philosopher, said in his days: "All purely logical explanations are worthless, since Nature far exceeds in fineness (*subtilitas*) all arguments drawn from inductive ratiocination."

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must silence envy, and the times appear gone by wherein a world falsely framed by fancy was deemed by men worth more than the real one. Even if many hypocritically turn their faces away from it, it is only done in pretence. In their deeds they manifest the contrary of their words. No one now tortures nor scourges himself, nor seeks asceticism in lieu of enjoyment. On the contrary each strives with all his powers to snatch the share of goods and of pleasures due to him, and offered to him by this life, beautified and exalted a thousandfold. To those, who nevertheless persist in turning their eyes to heaven rather than to earth, is applied the striking phrase of Ludwig Feuerbach: "The hypocrisy of self-infatuation is the cardinal sin of the age."

This is due more or less to those who, if not in everyday life, yet in theory and philosophy, continue to hold fast to that unreasonable idea of matter, already mentioned, as a dead, inert, dark, motionless, rough Something, opposed to the spirit and either hostile or subservient to it, rightly designated as a "horrid dream" by *F. A. Lange* in his "History of Materialism," and who from this theory deduce consequences which put fancies in the place of realities, self-deceptions in the place of truth. These foolish people utterly forget in their spiritualistic stultification that, as the study of the primal earth has clearly shewn, matter (out of which they have themselves arisen) *existed long long before the spirit*, and that all yet future forms, including reasoning beings, *potentially or in capacity* must have been contained in that primal world-mist out of which our solar system was gradually evolved with all its wonders and its inhabi-

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tants. They forget also that spirit can only exist on a substratum of organised matter, and that not the shadow of a proof can be brought forward to shew that spirit can attain to an independent existence outside matter. Further, they do not appear to know that all forces active in the earth, without exception, (including, of course, the spiritual ones produced by a definite arrangement of organised matter) *ultimately* arise from the sun and take origin in the form of light and heat coming to us by the vibrations of ether-particles. Lastly they overlook that which in fact is proved everywhere, that if spirit and matter were opposites they could not act upon each other, nor in any essential respect be transmutable. The simple solution of the problem lies in the fact that not only *physical* but also *psychical* energies inhere in matter, and that the latter always become manifest wherever the necessary conditions are found, or that, wherever matter is arranged in a certain manner and moved in a certain way in the brain or the nervous system, the phenomena of sensation and thought are produced in similar fashion, as those of attraction and repulsion are under other conditions. "If matter can fall to the ground then it can also think." (Schopenhauer.) In the form of a stone it falls to the ground; in the form of a muscle it contracts; in the form of living nerve-substance it becomes capable of feeling and of thinking, or rises into self-consciousness. The development of mind from matter is indeed one of the latest, most difficult and most complicated triumphs of physical forces, and is the product of a protracted toil, rising from step to step, through countless centuries, till reaching the height

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of humanity. Nor can we say what shall be brought forth of similar fruit by the coming ages; we must confess that perhaps as yet we see only the incomplete, the imperfect, and that perchance we have no conception of what matter may yet be able to accomplish in its further evolution in mental phænomena or faculties, by further complications and yet more highly developed forms of motion.

"The opinion that spirit has created matter", says the anonymous author of the 'Elements of Social Science' (London, 1854), "is an utterly groundless hypothesis, founded on no shadow of proof. There is not the smallest analogy in its favor, and it would appear as if human reason were yet in its childhood. In how much is it the least more conceivable that spirit should be infinite than that matter should be? It is indeed much more, infinitely more inconceivable; for while we can find no possible reason why matter should not be infinite, but are forced to that conclusion by the study of nature, we can on the other hand find no possible reason in nature why spirit should be infinite, but are forced to the conclusion that it is not infinite. Spirit is a manifestation of life, and all life, by the law of its being, is subject to change and therefore to death. Spirit is perishable, for it is absolutely indivisible from the perishable forms of matter, and it is a wholly natural force, not foreign to other natural forces, but indivisibly bound up with all other in mutual interdependence.... The spirit which designs in man is indissolubly bound up with a living organised brain. To maintain that the designer of the cosmical plan is a pure spirit is to argue against all analogy. According to our

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experience spirit is without exception found in conjunction with a brain, and never creates matter. . . . To separate matter from spirit, bodies from souls, is to destroy the truth of nature; to place one above the other is a monstrous presumption which destroys the unity of the universe."

"Divorced from matter", says *Tyndall*, "where is life to be found? Whatever our *faith* may say, our *knowledge* shews them to be indissolubly joined. Every meal we eat, and every cup we drink, illustrates the mysterious control of Mind by Matter."

There are philosophers who, in order to escape from the consequences of these or of similar considerations, go so far in their spiritualistic presumption as to deny or to throw doubt upon the existence of matter as such. The logical fallacy thus made has been cogently exposed by *Stanski* (Sur la spontanéité de la matière, Paris, 1873). It lies in this, that *the unknown idiosyncrasy of matter* (compare the chapter on the infinity of matter) *is taken for matter itself.* We indeed do not know what matter is in itself, any more than we know what force is in itself. We do not even know whether matter is single and simple, or if it is made up of the 60—70 known chemical elements. But this we know with all certitude, that something is there which attracts, repels, resists, moves, evolves the phenomena of light or of heat, and that when this something is taken away, the phenomena or activities evolved by it come to an end. This something is that which we call matter; the phenomena mentioned are its actions; and the cause of these actions is the force inherent in the matter. It is really comical that these philosophic

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gentry, after they fancy they have demonstrated the non-existence of matter and have shewn that it is merely a thing of thought, yet continue in their writings and expositions to speak again and again of matter and its effects. Did they care to be consistent, they should begin by denying their own existence, for this wholly consists of matter, and should regard themselves as non-existent appearances, or phenomenal modes of an unknown something, or as the product of their own imagination! With such ghostly antagonists one would readily waive all further discussion, even admitting — a thing which has never been seriously denied — that there are a number of properties of bodies which do not inhere in them as such, but which find their basis in the creation of our sense-organs.*)

After all that has been said, it scarcely needs any further demonstration that matter in reality is not that empty thing, furnished with a set of negative attributes, which it was so erroneously represented to be, but in truth is the very opposite. Matter is not dead, inanimate or lifeless, but — as will be more fully shewn in a later chapter — is in motion everywhere and is full of most active life. It is not shapeless; but — as again a subsequent chapter will shew — form, as well as motion, is its necessary and inseparable attribute. Nor is it crude, as badly informeded people, using the word in a bad sense, will have it, but is so infinitely delicate that all conception of it fails

*) Compare on this point and on the justice of the resuscitated, theoretically scientific scepticism of the present time the Note 82 p. LXXXIV of the author's work: "Der Mensch und seine Stellung in der Natur", II. ed. 1872.

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us. It is not worthless, but is the common mother and generatrix of all that exists or is coming into existence, and is thus of the highest importance. It is not senseless, spiritless or thoughtless, but is full of the most delicate sensibility and capable of the highest evolution of thought in the living creatures that proceed therefrom stage by stage. Neither is it unconscious, but in its gradual earthly process of evolution and development it evolves all imaginable stages of consciousness from the lowest to the highest. Further and lastly it is not unprogressive and eternally the same and unchangeable, as spiritualistic controversialists maintain, but brings forth ever increasing vital and intellectual forces by an ever higher and enhanced complexity of organic compounds. It seems to be only the impressions of our education, led ever in opposition to the progress of science along roads of spiritualistic fancies, which make it so difficult in the case of most people to see the simple truth, and to let the wellspring of fact come forth in place of phantasmic speculations and imaginations.

Materialists — albeit since the first publication of this book the term has become to some extent current and at each fitting and unfitting opportunity the designation has been dragged in neck and heels, unsuited though as it is to the defenders of a philosophy which regards matter, force and mind not as separate entities, but only as different sides or various phenomenal modes of the same primal or basic principle — have been overwhelmed by their countless opponents with a great number of accusations and charges, among which the reproach of (mental or moral) "grossness" has played a great part. They

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can, however, console themselves with the example of the great Greek philosopher *Anaxagoras*, who was compelled to leave Athens because, with a knowledge of nature or a foresight marvellous for his time, he declared that the sun was not a god, but a fiery ball, a glowing mass of stone. His great contemporary, the spiritualistic philosopher *Socrates*, spoke of him on account of this theory an "impious man" — an epithet which, if well-merited, must now be applied to the whole educated human race. This, like thousands of similar examples, shews, as *F. Mohr* strikingly remarks, that more courage is needed to think with consistency or to proclaim new truths, than to charge at hostile cannons.

For the rest, the whole struggle yet proceeding between Materialism and Spiritualism, still more that between Materialism and Idealism, must appear futile and groundless to him who has once attained to the knowledge of the untenability of the *dualistic* theory which always underlies it. All philosophical systems up to the present time have almost without exception been more or less dualistic, that is they have made a definite severance between matter and force, substance and form, being and becoming, movement and mover, nature and spirit, world and god, body and soul, earth and heaven, death and life, time and eternity, finite and infinite, — and all these things or conceptions have been placed in opposition to each other and been treated as antitheses, whereas modern science has shewn that these oppositions do not exist in reality, and that the separation can only take place in thought. There is no matter without force, but neither is there any force without matter; there is no

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mind without matter, but neither is there any matter without mind; there is no nature without arrangement, but there is also no arrangement without nature; there is no earth withou theaven, but neither is there a heaven without earth; there is no time without eternity, and there is no eternity without time; there is no finite without infinite, neither is there an infinite without a finite.

"Natur ist weder Kern noch Schale,
Alles ist sie mit Einemmale."

("Nature is neither kernel nor shell, but is both at the same time.") (Gœthe.)

Science is not idealistic, nor spiritualistic, nor materialistic, but simply natural; she seeks to learn everywhere facts and their logical corollaries, without doing homage in advance to a system in this or in that direction. *Systems* can generally include not the *whole*, but only half the truth, and offer to investigation certain hard and fast lines which, in its irresistible progress, it is compelled, or may be compelled, to overstep every moment. "Science", says Grove, "should have neither desires nor prejudices; truth should be her sole aim." *)

*) Further details on the relationship of Materialism, Idealism and Spiritualism, which, in this place, are only superficially dealt with, will be found in the author's already cited work on the Darwinian theory, in the two last essays; also in the work on Man, pp. 252—54, and LVI—LVIII; lastly in the book, "Aus Natur und Wissenschaft", in Essays 9, 12, 13, 22 and 31.

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MOTION.

Πάντα ῥεῖ (All things flow.)

Heraklitus of Ephesus.

Wherever our eyes dwell on the universe, whithersoever we are carried in the flight of thought, everywhere we find motion.

K. Zittel.

All is dependent on Matter and Motion.

P. A. Secchi.

Matter possesses one inherent quality; it is continual activity.

Gerhardt.

To explain an appearance is to lead it back to motion and demonstrate the conditions of motion.

Dellingshausen.

One of the strongest supports of the natural order of the universe and of a unified view thereof, is the knowledge that motion is a necessary and indispensable attribute of matter and of the whole organic and inorganic world. Physical astronomy teaches us with absolute certainty that the giant forms of the skies are in a state of constant change in shape and condition or constitution, like the forms of organic life on our earth; and apparently the ceaseless movements which they execute among and against one another, controlled by the law of gravitation or at-

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traction, are closely similar to those performed under gravity by the atoms and molecules, the finest constituent parts of each body or material form. For if, as *Secchi* says, the infinitely great is the province of the astronomer, while that which we may call the infinitely minute is the realm of the physicist and of the chemist, yet there is no distinction between the fundamental laws of mechanics which rule over each of these extremes. According to the same scientist, physicists to-day hold that motion is as indestructible as matter; and if people have gradually arrived at the conviction that no atom of matter is ever annihilated, he thinks they will also more and more recognise the indestructibility of motion as a fundamental axiom. In fact the English physicist Grove in the before-cited work (p. 16) proves conclusively that motion is the most evident state of activity or energy of matter, and that "of absolute rest Nature gives us no evidence; all matter, as far as we can ascertain, is ever in movement, not merely in masses, as with the planetary spheres, but also molecularly or throughout its most intimate structure: thus every alteration of temperature produces a molecular change throughout the whole substance heated or cooled; slow chemical or electrical actions, actions of light or invisible radiant forces are always at play, so that as a fact we cannot predicate of any portion of matter that it is absolutely at rest." The final result of his investigations is given by this scientist as that all the *conditions of matter* described by him *are modes of motion;* or that all these conditions "are only matter moved or molecularly agitated in certain definite directions." (p. 169.)

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Hence motion must be regarded as an eternal and inseparable property or as a necessary condition of matter. Matter without motion exists no more than matter without force; motion without matter exists as little as force without matter. Nor can motion be deduced from any force, for it is the very essence of force itself, and can therefore have no origin, but must be eternal and in all places. Motion is everywhere in the universe, in the small as in the great. The conception of dead or motionless matter is utterly untenable; it exists only theoretically or as an abstraction, and not in reality, like that of forceless matter. *F. Engels* (Streitschrift gegen Dühring, p. 40) speaks of a motionless condition of matter as "one of the shallowest and most absurd conceptions, a mere phantasm of a heated brain." According to him *motion is the mode of existence of matter.* Never and nowhere has there been matter without motion, nor can there exist any. Motion in the universal space, mechanical motion of smaller masses in the individual spheres, molecular vibration as heat or as electrical or magnetic action, chemical decomposition and composition, organic life — each single atom of matter in the world is in one or other of these modes of motion, or in many of them at the same time, at any given moment. All rest, all equilibrium is but comparative and has only a meaning as a transference from this or that definite mode of motion. For instance, a body may be at rest mechanically, *i. e.* in mechanical equilibrium on the earth; but this does not prevent it from sharing in the motion of the earth as in that of the whole solar system, neither does it prevent its smallest physical particles from completing the vibrations necessitated

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by its temperature, or its material atoms from undergoing chemical change. Matter without motion is as impossible as motion without matter; and motion is therefore as uncreatable and indestructible as matter itself.

In fact we are incapable, either logically or empirically, of framing a conception of motionless matter, or of a motionless body. When for instance a solid or heavy body, supported on a stand, continues in apparent rest, this rest is in fact but apparent, being in reality only an arrested or suspended motion, in which two equal and opposite motions balance each other. By removing the check the latent force can at any moment be re-transformed into dynamic force or work. The same holds good of an extended spring or of compressed air, etc. Rest must then be conceived not as incapacity for motion, but only as the resistance between two equal and opposite motions. And then the apparently inert body is not completely at rest, but only appears to be so in relation to its immediate surroundings. For it not only revolves with the earth on its axis, but also with it in its revolution round the sun, and with the latter again round the great central sun or the great centre of the milky way. "Everything," says *W. Mayer* (Kosmographisches Skizzenbuch, p. 217), "is engaged in motion with respect to its surroundings. Everything moves with the surface round the centre of the globe, with this round the sun, which ceaselessly whirls with us through space, and the mind becomes dizzy when it seeks to unravel this Gordian knot of interwhirling motions."

But even if this movement of our earth through space did not exist, the apparently inert body would yet appear to move, inasmuch as it takes part

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in the never-ceasing oscillations or vibrations of the interior and of the surface of the earth, which become apparent to our senses from time to time in stronger and more striking fashion as earthquakes, volcanic eruptions, landslips, overthrows of mountains, emergings of islands, etc. The firm earth resting on such apparently unshakable foundations is in reality anything but stable and immovable; it is only owing to the imperfection of our means of observation or perception that we are not permanently conscious of these never-resting movements, nor in a position to control them. On the other hand the observations and investigations of geologians have shewn beyond doubt that a continuous slow elevation of one, and a corresponding subsidence of another tract of land occur, and that so far as we know, there is no point of the surface nor of the interior of the earth which can be regarded as being in a state of absolute rest. The lightest pulsation of the sea or the softest breath of wind is enough to impart vibrations to the surface of the globe and the objects thereupon. "As we", relates *W. Meyer* (*loc. cit.*) "were assisting Prof. Plantamour in the autumn of 1877 at the Geneva Observatory in watching certain lately discovered movements which the point of support of a pendulum made with the pendulum itself, thereby influencing its period of vibration, we observed by a three-thousandfold linear increase the very slightest breeze, which, pressing against the strong sandstone wall of the low building from outside, set the wall vibrating."

But even if these cosmical and telluric influences, which impart some of the motions induced by them to apparently resting bodies, did not exist, they could not

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by any means be regarded as motionless, for their interiors are continually disturbed by a number of most powerful motions. For the most solid body owes its condition only to the mutual attractive force of its minutest particles, which continually oscillate or swing round the so-called centre of gravity, and without which it would at once fall to pieces. That these particles are never able to attain a condition of relative rest is proved by the universally present force of heat, which is known to be nothing more than a mode of motion and which, since all bodies without exception contain heat, keeps these smallest particles or molecules in a state of continual movement. With each change of temperature, however slight, is connected an internal motion; and this influence is sufficient to keep the whole of nature and all its substances and forces in ceaseless motion and change. Heat must indeed be regarded as the sole moving principle in the constant rotation of energies, without the presence of which a state of equilibrium would long since have been reached and therewith universal rigidity have set in. "All the substances in nature," says *Clausius* in an excellent treatise on the nature of heat, "even when they appear to be perfectly at rest, are engaged in the most rapid internal movement, and these movements in the bodies are transmitted to the surrounding ether, so that all space is continually traversed in every possible direction by wavelike vibrations, and the perception of these vibrations is what we term heat." "Heat and motion," says *Dü Prel*, "are the two factors out of which we must construct the laws of the cosmos."

But even this is not all; for apart from heat-

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motions every body, however solid, undergoes a constant, though often slow and unnoticeable change, or transposition of its particles and its shape. Even the hardest and most solid body of stone, which serves as an example of rigidity and immutability, forms no exception to this rule, and is, as the researches of chemical geology have shewn, in a state of constant inward change and transmutation, both on the chemical and on the physical side. As in the organic, so also in the inorganic world a constant change of matter takes place, and this may be best observed in the neighborhood of mineral springs. For it is chiefly water — especially when it is in a heated and carbonate-laden state — which initiates and assists each change, and it does so with unceasing and uninterrupted efficiency. After water it is the heat of the interior of the earth and mechanical pressure, and on its surface the influence of the atmosphere, which co-operate in a constant chemical and physical alteration and transmutation of the constituent particles of our ancient planet.

This transmutation obviously occurs most actively and most energetically in the organic world, the very existence of which depends thereupon. Even the province of latent or hidden activity is no exception to this, and if our senses or our means of observation were sufficiently keen, we should be able to observe in this also a constant change of composition and of form, while the external appearance deludes us with the image of absolute rest. "Nothing," concludes *Hanstein* from his researches on protoplasm, the primitive form of organic life (Heidelberg 1880), "is constant in shape and mass. Even the outline and the minute con-

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struction of the nucleus or seed, which perhaps are comparatively the most constant in the cell, do not remain the same. Each moment the parts may alter in number and in form, the body may change its structure or position, each molecular group may now firmly hold together, now freely dissociate itself. Yet are the form and individuality of the whole thing steadily preserved. 'Everything escapes and nothing subsists'."

In a former chapter we dealt fully with the law of the conservation or indestructibility of force, in order to shew that no kind of motion can originate nor disappear, and that motion must therefore be regarded as the primal condition or in some measure as the soul of matter. Before this law was known, it might well appear to the laity in many instances that a movement disappeared or was destroyed without leaving anything behind it, *i. e.* that it had passed into a condition of rest. This mistake is no longer possible, and this belief, founded on mere outward appearance, has been discovered to be one of the most radical errors which has ever ruled in science. Motion is as indestructible, as incapable of annihilation as force and matter; it assumes other forms, other appearances, of which the new forms are equivalent to those from which they have arisen. It follows hence with absolute certainty that motion is as eternal and uncreatable, or as beginningless, endless and originless as force or matter. Conservation of force, conservation of matter, ceaseless change of motion, work and velocity — such is the general result of our present physical science. So well had the ancient natural philosopher *Oken* understood this — although he lacked

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the positive knowledge of the present day, — that be made this remark: "Motion is from eternity"; and on the same grounds the philosopher *Descartes* was led to say: "Give me matter and motion, and out of them I will build the universe." The well-known physical law of the "inertia of matter" does not mean that matter is inert in itself, but only that rest or motion once begun cannot of itself change into its opposite, without being counteracted by some other force or motion. Rest is therefore not the absence of motion, but the resistance between two motions. Absolute rest does not exist; it is, as *W. Meyer* says, an exquisite dream, a phantom of hope which the world knows not, which is without an instance in Nature. Nature itself knows no death, but only change; no destruction, but only the passing over into other forms of motion; it is an eternally raging whirling sea of motion and of change.

Ruhe willst Du? Siehe doch,
Wie so thöricht Dein Verlangen:
Der Bewegung hartes Joch
Hält die ganze Welt gefangen.

Nirgendwo in dieser Zeit
Magst Du jemals Ruhe finden,
Und vom Fluch der Thätigkeit
Kann Dich keine Macht entbinden.

Ruhe kann es geben nicht
Noch im Himmel, noch auf Erden;
Und aus Tod und Sterben bricht
Neues Wachsen, neues Werden.

Alles Leben der Natur
Ist ein Meer von Thätigkeiten;

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Ohne Rast auf ihrer Spur
Must Du mit dem Ganzen schreiten.

Selbst des Grabes dunkles Thor
Gibt Dir Ruhe nicht hienieden,
Und aus Deinem Sarg hervor
Sprossen neue Lebensblüthen.

("Dost thou ask for rest? See then how foolish is thy desire; the stern yoke of motion holds in harness the whole universe. Nowhere in this age canst thou ever find rest, and no power can deliver thee from the doom of activity. Rest is not to be found either in heaven or on earth, and from death and dying break forth new growth, new birth. All the life of nature is an ocean of activity; following on her footsteps without ceasing thou must march forward with the whole. Even the dark portal of death gives thee no rest, and out of thy coffin will spring blossoms of a new life.")

The eternity of motion and its necessary existence were laid down as axioms long ago by the most ancient Greek philosophers who lived prior to the Socratic age. Especially did the atomists, *Leukippus* and *Demokritus* and their famous disciples *Epikurus* and *Lucretius*, regard it as self-evident that the atoms, out of which proceeded all existence, should be considered as having been in motion from all eternity. On the other hand, *Anaxagoras* (500 B. C.) was the first who divided spirit from matter, and derived motion from the activity of a reasoning ordering spirit (νοῦς). He was followed by Plato's pupil *Aristotle*, who also held matter to be incapable of self-movement and maintained the necessity of the existence of a world-mo-

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ving spirit or reason, or a *primum mobile*, not moved by anything else. This opinion, which was thoroughly acceptable to the Christian conception of God, was sustained by the powerful influence of the Aristotelian philosophy down to the times of Descartes and Spinoza. Thus, the great mathematician *Newton*, the discoverer of the law of gravitation, considers matter as originating and set in movement by the will of God. *Leibnitz* (1646—1716), one of the most comprehensive minds that ever existed, was the first to venture upon stating once more that motion was self-originated. "Everywhere", he says, "there is activity, and I give it a firmer ground than does the ruling philosophy, for I am of opinion that there are no bodies without motion, and no substances without mighty energies." According to this view, matter is neither dead nor inert, and is not impelled nor driven from outside in some fashion by some *deus ex machina*, but has in itself force and resistance. The conception of dead matter is a mere abstraction, answering to nothing real, for matter, as we known experimentally, is everywhere full of life and motion and bears within itself its formative energies. Just the same view relating to matter was maintained by the materialistic philosophers of the eighteenth century. According to *Holbach* ('Système de la Nature') the world is nothing more than matter and motion and an endless concatenation of causes and effects. Everything in the universe is in constant flow and change, and all rest is but apparent. Matter and motion are eternal. — Diderot and his successors held the same opinions.

And all this is entirely borne out by modern science. The investigation of motion is her peculiar

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task, and her province embraces everything that may be traced back to motion. Matter in motion or capable of motion is or must be her first and last word. "Eternal motion in infinitely manifold forms," says L. K. Popow, "grouping itself together and dissociating itself, but never wholly disappearing — that is the nature of the cosmos as a whole."*)

*) "Motion" is dealt with at greater length in the author's work "Natur und Geist", pp. 109—138.

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FORM.

The mass of living things does not present itself to us as the carrying-out of a reasoned, designed and followed plan, but as a historical result; that is, as the continually modified outcome of a number of causes which have acted successively, and in which there is a cause for each accident and each irregularity — the plan has no existence save in appearance. Forces necessarily work blindly, and existence arises from their co-operation. If any one imagines that nature works on a serial plan, he will find himself mistaken. The series is a result, not a thought, not a design of nature; it is nature itself. — It is, however, perfectly obvious that if the forces of the whole universe constantly act uniformly upon our globe, their work must form a complete and perfectly graduated series.

Jouvencel.

This formative law is and remains a purely teleological, incomprehensible, immaterial principle, in its essence identical with vital force.

Haeckel.

Nature is generally more simple than our conception thereof; we begin with very complicated theories and end with the most simple.

Dü Prel.

The idea of form can no more be separated from that of matter than can those of force or of movement be separated from it. A shapeless matter is a non-entity, neither logically conceivable nor empirically present in nature. Let anyone think of matter as he

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will, he can only think of it under some form, even if it be an embryological or incomplete one; and experience shews that even that chaotic mass of matter or primal world-mist, which must be regarded as the embryo of future worlds and solar systems, appears to the observer under the most varied forms. Form however did not spring from matter, as Minerva did from the head of Jove, but in the perfection in which we now see it is the result of slow and laborious evolution, which took millions upon millions of years in the doing. And indeed this evolution proceeded in such fashion that no doubt remains that we cannot speak even in the very widest sense of a preconceived plan or a preordained formal order, but that all militates most emphatically in favour of Nature's own action in the moulding of her form without any previous design. But since this action had occasion ever to develop itself under external and internal circumstances that were slowly and gradually changing in every direction in a uniform manner and without interruption, it is obvious that an *apparent* order and an *apparent* plan should have arisen, that is to say, that a perfectly graduated series of more and more perfect forms should have developed. Had these forms been in any way imposed upon nature from without or from above, or were they — to say the least — the outcome of preconceived ideas or of firmly-grounded principles, then would the processes be wholly incomprehensible by which were shaped, step by step, the forms of the universe, or of the different solar and planet systems, or of our earth with its living organic or inorganic formations. In all these formations do we behold so much in the shape of accident, irregularity, imperfection

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and dependence on changing circumstances or conditions that the theory of a pre-ordained formal arrangement is met by insuperable difficulties. On the other hand, the endless astonishing variety of formations in nature, in which an absolute repetition is never found, is the best proof of the eternal internecine conflict in matter, evoked by the conflict of the forces at work therein. Let anyone study the wonderful and beautiful forms of snowflakes or snow-stars falling to the ground on a cold winter's day, and he can convince himself that one day the forms are quite different from those of the day before or of the day after, although the conditions may differ but in the very smallest degree. Nevertheless this minute difference has sufficed to evolve these very different forms; it shews that, as *Carus Sterne* ('Sein und Werden') says, "each of these fugitive forms is the exact expression of a special complex relation between the moisture, motion, pressure, temperature, rarity, electrical tension and chemical composition of the air that prevailed during their formation. With a manysidedness of ideas, which anyone engaged in the drawing of patterns and designs for fabrics might envy, the intrinsic faculties of the simplest and most indifferent compounds we know of shew themselves thus in opposition to the moulding influences of the outer world."

Still more does the gradual evolution of the organic world prove most conclusively — since herein the strife of forms in nature has reached its highest point — that form is nothing more than the necessary result of material actions and counteractions. Slowly and only with the help of an almost unending series of years have these organic forms attained their present

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perfection and variety, and now reveal to us in this fashion all imaginable varieties and transitions, and a ceaseless interchange of form and mode of living, according to the variations of the external and internal influences under which they lived or were constrained to live. Only through countless transitions and transformations could they evolve the vegetable and animal worlds from the scantiest and most imperfect beginnings up to the present wealth of forms, and this we shall shew and illustrate more fully in a later chapter. None of these forms, whether they belong to our own age or to prehistoric ages, manifest in any one instance fixed character, which they preserve unchanged as a distinct type throughout varying external circumstances. On the contrary; everywhere this type is easily changed, and there is no type of any organic group of which there cannot be found the most striking exceptions and variations. Indeed, by virtue of the proofs yielded by the theory of evolution, there can now be no doubt, that the types, or organic phyla, which, at their furthest points, appear most severed from each other and of the most diverse kind, such as the birds and reptiles or the fishes and the higher Rotifera, are closely connected at their points of origin, and that everywhere a higher type can be educed from a lower, and a lower from one still further beneath it. All this shews that form is not a firmly fixed nor a pre-ordained type, but is more or less accidental, that it is not original but proceeding from gradual amendment, not essential but superficial, and dependent upon circumstances without which a material entity cannot be conceived.

A yet stronger argument in favour of this theory

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is found in the single fact that — as has been proved beyond doubt by modern biological science — the whole range of the organic world from the lowest to the highest, from the simplest to the most complex forms, has been made up of a single and very simple form-element and from its products, the *cell*, and that this simple form, which consists, of enclosure, contents, and nucleus, arises again from a yet simpler original compound of matter, viz. the *protoplasm* or formative matter. This protoplasm or living matter, the remarkable vital properties of which are due to the peculiar chemical and physical properties of the *carbon* it encloses, and of its compounds, presents itself in a semi-coagulated, homogeneous form of larger or smaller bodies of albumen, capable of nutrition and reproduction, in which all organic functions are not, as in the higher animals, discharged by special organs, but are the immediate outcome of the unformed organic material. These forms thus stand on the border-land between organic and inorganic bodies and clearly reveal to us how organic beings are gradually developed out of more or less formless compounds of matter, through influences and circumstances which will be more fully investigated in a later chapter.

What the cell is to the organic, the crystal is to the inorganic world, although we must not allow ourselves to be led away into the false idea that the two kingdoms can be sharply divided off by this difference of shape, and that they can be separately built up on these foundations of completely distinct forms. For as the cell springs from the protoplasm, so does the crystal form itself out of the shapeless mother-ley or out of previously amorphous, *i. e.* form-

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less bodies by mere re-arrangement of atoms, and, in doing so, manifests very striking signs of an inner life, which do not allow us to look on it as a mere aggregation of lifeless matter, but shew manifold resemblances to the internal processes of plant and animal life. In point of fact, the remarkable proteid or albuminoid crystals, discovered by *Reichert* in 1849, or *Nägeli's* so-called "crystalloids", which behave exactly like organic bodies and exhibit all the peculiar properties of protoplasm, practically fills up the apparent gulf between cell and crystal or between the inorganic world and the organised cellular formations of the plant and animal worlds. In fact, a crystalloid can only be regarded as a crystallised cell or as a cell-like crystal; we are constrained to agree with Nägeli when, basing his opinion on such facts, he declares that the difference between inorganic and organic is no other than that which exists between the simple and the complex.

Under such circumstances it cannot surprise us to find that the lowest living things, which stand on the lowest steps of organic existence midway between plants and animals, the so-called protista or primitive life-forms, manifest in their various shapes a startling approach to the inorganic world, and in contradistinction from the more highly developed plants and animals, shew mathematical outlines most closely resembling crystals and crystalline forms. "If", says *Haeckel* (The Realm of the Protista, pp. 38 and 46), "the formative power of the formless protoplasm calls forth our highest admiration among the remarkable Polythalamia, this is yet increased when we turn to the nearly allied *Radiolaria*. In these most interesting primal beings we

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meet with the greatest variety of beautiful and strange forms that can be found in the organic world. All possible types which could be placed in a promorphological system are found embodied in these." — "We have as yet no conception of the significance of these very varied, strange and exquisite forms, nor of the way in which they are shaped by the formless protoplasm of the Radiolaria."

From this common root of the plant, animal, and mineral realms that whole rich world of forms in nature with which we are surrounded to-day, has gradually developed by slow differentiation and improvement. "Just as with crystals", says *Jouvencel* (History of Creation, II, p. 308) "each tetrahedral and prismatic type is capable of passing by consecutive modifications into ever more complex forms, so were the earliest primeval forms of life capable of taking on ever more complex forms by consecutive modifications. But as among crystals all forms, even the most complex, of any given type, are obtained by a very simple process of modification, viz. the formation of new faces by a consecutive deposition of new molecules — so in the case of the living thing even the most complex forms can be evolved from a given type by a very simple process of modification, which consists in the formation of new parts by a consecutive addition of new cells."

We therefore require no mysterious "type-creating power", no peculiar law of formation, no pre-ordained scheme of thought to account for the existence of form, but only a simple contemplation of nature as she is. Form is not a *principle* but a *result*; it is not the execution of a predesigned plan, but the necessary product of the interaction of a large number of causes, contingencies

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or energies, which, blind and unconscious in themselves, yet working on everywhere and at all times without cessation, cannot but produce an apparently perfect and graduated order and succession. When the ancient philosophers of Hindustan and Greece could not reconcile the opposition between matter and form and sought, now to get out of the difficulty by the conception of an eternal form-design of matter, now by setting form against matter as the higher and ruling principle, now by treating both on terms of equality, but still as antitheses, it was scarcely possible to do otherwise at a time when the principles of the theory of evolution had barely dawned upon the human mind yet. To-day, when we are to some extent in a position to follow up the history of the endless events lying behind us, in ascending to the world-embryo of primal mist, it should be recognised that to exaggerate the importance of form, as is still done by many scientists, is as much an error as to exaggerate the importance of matter. The former leads to Idealism, the latter to Materialism; but the conception that form and matter are as indivisible as matter and force or as matter and motion can only lead to that unified conception of the world, based on the recognition of a natural and self-existent order of things, which, taking its stand on the progress of science, is destined to become more and more the common creed of all men of culture.*)

*) Further details or the questions treated of or alluded to in this chapter may be found in the author's works: "Natur und Geist", pp. 141—156; "Physiologische Bilder", I. pp. 187—283; "Vorlesungen über die Darwin'sche Theorie", at the end of the first essay.

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IMMUTABILITY OF NATURAL LAWS.

> The government of the universe should not be regarded as the ordainment of the world-order by an extramundane intelligence, but rather as the immanent intelligence of cosmic energies and their proportions.
>
> **Strauss.**

> The energies working in matter work, so far as our observation extends, according to immutable laws, which never exception, but which always have been and always will be valid.
>
> **Th. Moldenhaur.**

> If modern science denies miracles, it is only to reveal to us a world which is in itself an everlasting miracle.
>
> **A. Langel.**

The laws by which Nature works and acts in her endless movement, in her ceaseless being and becoming, in building-up and destroying, are not, as the childlike phantasy of nations used to imagine them in ancient times and as weak and uncultivated minds still believe at this day, laid down and dictated to Nature by some lawgiver or lawgivers standing outside or above Nature, but are the natural and necessary expression of the interaction of all physical forces. By analogy with human activity and conditions the inaccurate and misleading name of

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"law" has been employed to express this fact. But this analogy is inapplicable, because the phenomena or facts of Nature, interlinked by absolute necessity, have nothing in common with the arbitrary commands of a human lawgiver. The law of Nature does not exist beside nor outside matter or Nature, but is only, as stated above, an expression for the properties or motions indissolubly united with it. While human laws necessarily presuppose a lawgiver or a controlling will, be it that of a single ruler or that of the community at large, it is not so in the case of natural laws, which are not imposed upon matter or upon Nature, but are inseparable from and identical with her very self.

Hence it follows — as has been proved beyond doubt by experience — that natural laws are immutable, that is to say, that they are inaccessible to caprice or to outside influence, and that they must be regarded as being as eternal as matter and as Nature itself. Nothing can happen in the universe, be it the greatest or the least of things, except by the influence and as the result of natural laws. Rigid inexorable necessity rules the whole and the course of Nature. "Natural law", says *Moleschott*, "is the most stringent expression of necessity." There is neither exception nor limitation here, and no conceivable power is able to escape from this necessity. At all times and for evermore, a stone which is upheld by no support falls towards the centre of the earth; never has a command been given, nor ever will such be given, bidding the sun stand still in heaven. The experience of more than a thousand years has pressed on observers the conviction of the immutability of natural laws with ever incresing and

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at last with such absolute certainty, that not the least doubt can remain as to this great truth. Inch by inch has science, in seeking after light, won their positions from the ancient childish creed of the world, wrested from the hands of the gods their thunder and lightning and the darkening of the stars, and has subdued under the controlling fingers of man the mighty forces of the old-world Titans. All that seemed incomprehensible, miraculous, caused by a supernatural power, how quickly and how easily has the torch of investigation shown it to be the outcome of hitherto unknown or imperfectly estimated natural forces; how swiftly did the might of the spirits and the gods melt away beneath the hands of science! Superstition must fall before cultured reason and knowledge must step into its place. With the most absolute truth and with the greatest scientific certainty can we say at this day: There is nothing miraculous in the world; everything that happens, has happened and shall happen, happens, has happened and shall happen *naturally;* that is to say, in a manner that rests exclusively on the regular working together or interaction of materials that have existed from all eternity and of the natural forces united with them. No revolution of earth or sky, however violent, could have taken place in any other way; no mighty hand, reaching down from the ether, raised up the mountains and limited the seas, nor traced their orbits for the suns and planets, nor created animals and men after its own whim and pleasure; but all this was done by the very same forces which at this day still make seas and mountains, regulate the course of the worlds and bring forth living things; *and all this took place as the expression of the most*

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stringent necessity. Where fire and water meet, there vapor must arise and exert its irresistible force on its surroundings. Where a grain of corn falls on the ground, there it must grow. Where the lightning is attracted there it must strike. Where two bodies with chemical affinity meet under certain conditions there they must combine, and under other conditions they must separate. When an organism suffers an incurable injury it must perish, and so on. Can there be any doubt about these truths? No one who has studied nature and his own surroundings even in most superficial fashion, and who knows the merest outlines of the acquisitions of natural science, can help becoming convinced of the necessity and immutability of the laws of Nature.

"Everywhere", says *G. H. Schneider* (Der thierische Wille, p. 137 *et seq.*), "we observe only immutable natural laws and blindly working causes. Hence the ghost of a personal, universal spirit, interfering in natural processes, has long been banished from astronomy, physics and chemistry; no chemist now thinks of ascribing the union of two elements to the will of a god, and no scientist now sees the manifestation of the divine will in any phenomenon of attraction or friction. The ignorant layman may believe in a personal god; but the scientist or the educated layman, who is able to grasp the fact of adaptation without assuming the will of a personal god, would place his reason below that of the simplest peasant if he believed in such a one without foundation. . . . Belief in God is therefore almost confined at the present time to those so-called learned men who know scarcely anything about natural processes, and who are

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therefore compelled to fall back on the will of a personal god for the explanation of the simplest physical processes" etc.

As with the doings of nature so is it also with the doings of man, which arise from natural causes and influences, and which similarly obey that inexorable regularity which rules throughout all existence and which admits of no exception. It lies in the nature of each individual being that it should begin, exist and perish, and no living thing has ever yet formed an exception to this rule. Death is the surest calculation that can be made, and is the inevitable fate or end of every individual existence. His hand is stayed by no mother's prayer, by no wife's tear, by no man's wrath; he snatches the blooming child from the arms of the despairing mother or the tender parent from the side of the helpless child; he reaps terrible harvests and incessantly goes on heaping up hecatombs of perished lives, the destruction of which brings pain and anguish, trouble and poverty on the bereaved. "The laws of Nature," says *Vogt*, "are rude, unbending forces, which know nothing of morality nor of compassion." "Nature," says *Dü Prel*, "is neither cruel nor loving, neither tender nor hard-hearted; she merely acts according to laws, and in the whole universe not an atom moves except by law." No power in the Universe quells the wrath of the elements, contending against each other and against men with destructive violence; no command from on high checks the devastating fury of storm, water or burning sun; no call wakes the dead from their sleep; no angel lets the prisoner out of his dungeon; no hand stretched out from the clouds reaches bread to the

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hungry nor drink to the thirsty; no sign from heaven grants supernatural knowledge; no light from above gives comfort or solace to the despairing soul. "Nature," says *Feuerbach*, "answers neither the questions nor the plaints of man; she inexorably flings him back upon himself." And even *Luther* found himself compelled to say in his ingenuous way: "For we see by experience that God does not take care of this temporal life." The same thought is expressed by *Leopardi*, the famous poet of Pessimism, in the following words: "Yet O Nature, as I understand the world, thou troublest not thyself in thy courses over our good nor over our ill."

We know of no "spirit that is independent of natural forces in its manifestations", as *Liebig* terms it; for never has an unprejudiced and scientifically trained observer discovered any such manifestations. And how could it be otherwise? How would it be possible that the unchangeable order and regularity in which all things move could ever have been destroyed, without making an irreparable rent in the Universe, without handing over ourselves and the world at large to an unfathomable and unspeakable arbitrary will, and without making all human science appear as mere childish drivelling, all earthly effort as idle toil or as a useless striving after something that in a higher order of things would have been obtained long ago? Above all, what object or significance could there be in this whole world, regularly appointed and developed as it is, if it were under the arbitrary influence of a higher power which could at any moment suspend or break through its laws or institutions at its own pleasure?

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Such exceptions to the rule, such deviations from the normal order of things have been called *miracles*, and plenty of them have been put forward in all ages. Their origin is due partly to intentional fraud, partly to superstitious ignorance and to that strange longing for the wonderful and supernatural which seems indelibly wrought into human nature. How plainly soever the facts may speak, it is difficult for man to persuade himself that he is everywhere and under all circumstances surrounded by a network of uninfringible laws. The idea produces a feeling of oppression within him, and he does not resign the hope of discovering something that might break through this network. The younger and the more uncivilised and uneducated the human race, the greater play must have had this desire, and the more numerous must have been the miracles wrought; for as *Radenhausen* says: "the more ignorant man is, the more miracles must there be for him". Even at this day, among savage and ignorant nations and among the uneducated generally, there is no lack of miracles, and there remains rampant a belief in goblins and *diablerie* and in certain higher influences mocking the laws of nature; even the shocking belief in witches and the devil, under whose poisonous breath our unhappy deluded race had to suffer heart-breaking tortures for such a length of time, still prevails among the lower classes of our society, despite its vaunted high degree of civilisation—not to mention the miracles and apparitions to which the priests treat the unthinking multitude every now and then in various places and which prove such great and highly remunerative attractions. It would be an insult to the

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intelligence of our readers, were we to further expatiate on the physical imposibility of miracles. No educated man who has acquired but the most superficial knowledge of nature, still less a man proficient in science, can at this day believe in a miracle or in the possibility of anything happening in opposition to the recognized laws of Nature. We only consider it most remarkable that a man possessed of so much acumen and of such a clear mind as *Ludwig Feuerbach,* should deem it necessary to use all his dialectic power to upset the Christian miracles. Where is the founder of a religion who did not think it incumbent on him to usher it into the world with a flourish of miracles? And did not in each instance the result shew that he was right? What prophet, what saint has not worked miracles? What seeker after miracles does not even at this day find plenty of pabulum to satisfy his craving with? And do not they also belong to the miraculous, those talking and dancing tables, those drum-beating spirits, those spiritualistic mediums and those beings of four-dimensions, who rejoice in so large a following and have inveigled even men of a serious turn of mind and men of learning into the meshes of their folly? In the eyes of science all miracles are alike, they are the outcome of an ill-regulated fancy, combined with an utter ignorance of the laws of Nature.

"There are no miracles in Nature," says the famous *Système de la Nature,* "except for those who have not sufficiently studied her."

"Every miracle," says *Cotta,* "if it really took place, would lead to the conviction that Creation is unworthy of the reverence with which we all regard

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it; and were there any, mystics would have to infer from the imperfection of the things created, that the creator also is imperfect."

"Miracles," says *Giebel*, "are the greatest monsters in the sphere of natural science, in which no blind faith holds good, but only the knowledge acquired by personal conviction."

And *Jouvencel*, the French savant, says: "I believe neither in chance nor in miracle, but only in phenomena regulated by laws."

Would any one have thought it possible for the clergy of a nation so intelligent as the English to have given in the face of the whole world a proof of such crass superstition as they did in their controversy with Lord Palmerston which created quite a sensation at the time? When they moved the government to have a day of national humiliation appointed for the purpose of averting the cholera, the noble Lord answered that the spread of the disease was owing to natural and partially known causes, and could be prevented very much better by sanitary measures than by prayer. For having given this sensible answer, Lord Palmerston was taxed with Atheism, a much more serious charge in England than anywhere else, and the clergy pronounced it to be a sin of the deepest dye not to believe that the Almighty could at any moment set aside the laws of Nature as he pleased! Any commentary on this would be superfluous.

Dogmatic works declare that the view that the world, like a wound-up watch, can go on regularly by itself, is a view unworthy of God; in their shewing, God must be regarded as the constant regulator,

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who either creates anew or gets the machine over all the hitches it is subject to. On that account, our great master of natural science, *A. v. Humboldt*, has been censured by some for having represented the cosmos as a complex arrangement of natural laws and not as the product of a creative will. They might as well blame the natural sciences for existing, for not a single author, but science itself has taught us to regard the cosmos as a complex arrangement of unchangeable natural laws. Whatever theological interest or narrow-minded pedantry can urge in opposition to this, is controverted by the strength of the facts, which in this respect leave no room for any doubt. To be sure, our opponents know how to adduce plenty of facts on their side of the case. If we are to credit the accounts of the Bible, God created the world in six days and, according to the contention of theological geologists, has never left off, since then, calling, ever and anon, new entities into being. To be sure, he once dried up the Red Sea, so that the Jews might pass over it, and in all ages he has frightened people out of their wits with comets and eclipses. The New Testament tells us that he actually clothes the lilies of the field and feeds the birds of the air. But where is the educated person who, at this day, beholds in these occurrences anything more than the results of natural causes and conditions? and who is ignorant of the fact that neither the lilies of the fields nor the birds of the air could exist if the natural conditions of life remained unfulfilled? — And lastly, can it be regarded as a very dignified view of the Deity to imagine, as the great *Newton* thought himself compelled to believe, that God re-

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presents an extramundane power or force, which every now and then gives the world a push, adjusts a screw or does similar things, like Sam Slick the Yankee clock-mender? The theological theory makes out — and it could not very well do otherwise — that the world was created by God faultless and perfect. How then can it want repairing?

It stands to reason, therefore, that the conviction of the immutability of the laws of Nature is the same among all unprejudiced investigators, who only differ in the fashion in which they seek to make this conviction agree with the traditional belief in the existence of a personal omnipotence, or intelligence, or creative energy, or so-called absolute power. Both naturalists and philosophers have tried their hand at it for a long while in many different ways, but apparently with the same unsatisfactory result. Indeed, it was scarcely possible for these attempts at reconciling faith and science to prove successful, if carried on scientifically; for they either contend against facts, or trespass on the province of theology, or entangle themselves in contradictions, or shelter themselves behind an impenetrable obscurity. Thus, for instance, the famous *Oersted*, the discoverer of electro-magnetism, says: "The world is governed by an eternal intelligence, which manifests to us its workings as immutable natural laws." But nobody can comprehend how an eternal and ruling intelligence can be in unison with immutable natural laws. Either the natural laws rule, or the eternal intelligence rules; working side by side, they would get at loggerhead at every moment; the rule of the latter would render the former useless, while the working of immutable

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natural laws admits of no exception nor of any personal interference, and therefore can never be set down as a system of government rule. On the other hand we cannot deny ourselves the pleasure of noting a sentence from the same authority for the benefit of those who hold that this recognition of the working of immutable natural laws must need produce a feeling of alarm and depression in man. "By means of this knowledge," says Oersted, "the soul obtains internal peace and unison with all Nature and is thereby relieved of that superstitious dread, which has its foundation in the idea that some supernatural powers can interfere with the order of the eternal course of Nature." The same thought is expressed by *W. R. Grove* as follows: "To the educated man the feeling of acquired knowledge yields a higher satisfaction than the love of the miraculous"; similarly by *Radenhausen:* "Self-reliance must increase with the knowledge that the world is ruled not by capricious, unknown spirits, but by known infrangible laws."*)

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*) Ever since popular works have diffused the results of modern science among classes that had not been previously reached by it, cries of woe and lamentations innumerable have come from all holes and corners, complaining of the "disconsolate nature" of these results, and this wailing has, if it be possible, become even more frenzied since the appearance of the first issue of this book. Complaints of this kind are mostly uttered by ignorant people only. The exceptionless regularity which rules the World and Nature, and the limits of which cannot be overstepped by any individual, and the consciousness that nothing within us or around us is caprice, but that all is necessity, are, on the contrary, calculated to produce in the mind of a rational being a feeling of humility, and at the same time one of repose, self-contentment and self-respect, and to yield an inward strength

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Most signally have those failed who regard the supreme or absolute power as so interwoven with the things of nature as to cause everything that happens to take place by his direct influence, though in accordance with settled laws; or in other words, that the world is a state ruled by laws, a kind of constitutional monarchy. The immutability of natural laws is such that in no place and at no time has an exception to them occurred, that under no circumstances do they reveal the working of a controlling hand, and that their interaction constantly takes place quite independent of all rules of a superior intelligence, now building up, now destroying, now apparently according to a design and now again quite blindly and in opposition to all laws of morality or reason. Some of the facts that are as obvious and as plain as daylight shew that no guiding intelligence can be directly at work either in the organic or in-

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that does not rest on doubtful fancies, but on certain knowledge of the truth. How beautifully is this sentiment expressed by Virgil, in the famous lines so felicitously rendered by Dryden: —

> Happy the man, who, studying Nature's laws,
> Through known effects can trace the secret cause —
> His mind, possessing in a quiet state,
> Fearless of fortune and resigned to fate!

Any other opinion, which seeks to refer the destiny of man to its relation with an unknown, capriciously acting and ruling Something, degrades him to a mere toy in the hands of unknown forces, to a powerless ignorant slave of an invisible lord. "Are we but sucking pigs, who are flogged to death with rods for princely tables, that their flesh may taste more savoury?" (Hérault in Georg Büchner's "Danton's Tod".) — "He who finds this theory of the universe comfortless," forcibly remarks *A. Wiessner* (Der wiedererstandene Wunderglaube, Leipzig, 1875), "philosophises with wishes instead of with knowledge."

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organic formations that are continually renewing themselves upon the earth. There exists in Nature a tendency to form which is the outcome of a definite formula and is so blind and so dependent upon casual external circumstances, that it often gives birth to the most senseless and aimless forms, that it is often incapable of surmounting or conquering the smallest obstacle it meets in its way, and that it frequently obtains the very opposite of the effect which it ought to obtain according to the laws of reason or intelligence. We shall take the opportunity of adducing an abundance of examples of this in a subsequent chapter, viz. in that on Teleology. It thus happens that the theory alluded to has found the fewest adherents among naturalists, who have daily and hourly opportunities of satisfying themselves of the purely mechanical action of physical forces. — Rather a larger number of people have given in their adhesion to a compromise which consists in submitting to the force of facts and admitting that the present play of physical energies is wholly mechanical, utterly independent of any impulse received from without and in no way arbitrary, while contending, on the other hand, that this state of things cannot have existed from all eternity, but that a creative power, endowed with the highest intelligence, both created matter and imparted to it those forces and laws, binding them up with it by an indissoluble union, according to which it should work and live; and that, having done all this, the creative power gave to the universe the first impulse to movement and thenceforward subsided into inactivity. "There are many naturalists," said *Rudolf Wagner*

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(Ueber Wissen und Glauben, 1854), "who believe in an original creation, but who maintain that since the creation the universe has been left to itself and preserved by the excellence of its intrinsic mechanism."*) In an earlier chapter, we have already expressed at some length our views as to the tenability of this theory, and shall have to revert to it again hereafter in dealing with creation in detail. It will there be shewn that the traces of a direct creation can nowhere be found among the facts at our command, but that everything rather compels us to set aside such an idea and to look upon the eternal changeful play of physical forces alone as the primal cause of all evolution and decay.

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*) This view has been gone into at greater length and with more detail by the famous scientist *G. A. Hirn* in his interesting little book entitled: "La vie future et la science moderne" (1882). He says: "For the scientist the only necessary act of the creative omnipotence is the creation of the form-producing elements with their properties, and a first compound of these which may have had no resemblance to those forms now under our eyes. It is the *Fiat lux* for everything that fills space; matter, force, life... For the scientist the universe, as it is now before us, is the result of a gradual evolution. The elements that were originally scattered throughout space, have gradually approached each other to build up definite forms; but the whole universe was virtually in the condition of a primal mass of vapor and has evolved thence according to the definite laws impressed upon the elements. To say that earth, moon, sun and stars were created severally as complete bodies, is as ridiculous in the eyes of a scientific man as if, for example, one were to say to any one who is not a scientist: "A tooth has been created for your child." In a word, for the scientist Creation is reduced to a single act of the creative omnipotence, while it appears to the layman as a series of separate acts; and a perfect abyss lies between these two views."

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"I am of opinion," said the famous *Kepler* long ago, "that we should try every other method of explanation first, before we take refuge in the *admission* of creation (that is, in miracle), *for when once miracles are admitted, every scientific explanation is out of the question.*"

It is no part of the object of this work to take much notice of those who seek and find in the province of religious faith an explanation of the problem of existence and a satisfaction of their moral wants. We are only busying ourselves with that world which is accessible to our means of intelligence, and can find no scientific reasons compelling us to believe that behind this world there is another, a higher one, independent of the influence of the laws of Nature and perhaps arranged in an entirely different fashion. But for this very reason we have not the remotest intention to impugn the rights of those who fancy that they can find in such theory any comfort for their souls. Let every one believe whatever and as much as he likes, and let his fancy have free scope where science forsakes him! Faith and knowledge belong to two entirely distinct provinces, whose boundaries are constantly changing, and the change always takes place at the expense of the former and not of the latter. There are departments which, but a hundred years or so ago, were wholly under the sway of religious faith, and which at this day are occupied by science; and as time goes on, this will continue to be the case to an ever increasing extent. „It is impossible," says *Virchow*, "to calculate faith scientifically; for science and faith exclude one another." Theology and Natural Science cannot walk peacefully side

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by side, and a theological or ecclesiastical natural science does not and cannot exist until men drop down ready-made from heaven, and until the telescope gazes into the meetings of the angels. He who cannot put up with this and with the naked truth, may cling to faith, but for scientific investigations truth is the only available standard. Nor is truth arid or disconsolate; for it is in the very nature of true knowledge to restore more with one hand than what it seems to take away or destroy with the other. It is not therefore necessary that those who love the truth more than they do Plato or Socrates, should follow the well-known advice of a distinguished naturalist, who suggested that people might have two separate consciences, a scientific one and a religious one, which for the sake of peace should be kept strictly separate, seeing that they cannot possibly be made to agree with each other — a system which is technically known by the name of *book-keeping by double entry*. He who considers such a double entry as necessary or desirable for the repose of his conscience, and does not shrink from its logical difficulties, may always put it in practice on his own account, but he should not seek to introduce it into science, nor into the rational view of Nature. Our English neighbours have succeeded in managing this affair far better than the German scientists, by inventing the well-known distinction between *first* and *secondary* causes. No more of that unnatural setting-up of two separate methods of thought or of that mixing-up together of the natural and the religious view of the universe. Everything passes off in a natural and regular way; a break in the connexion of

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causes and effects is not possible, since *one* secondary cause is necessarily linked on to another; and if this connexion is not found or discovered everywhere, it yet exists and its discovery is the aim of science. But human science does not and cannot get beyond this search into secondary causes, since the totality of existence and the order that rules it, depend in the last resort on a supreme or first cause, which does not indeed interfere with the ordinary course of events, but which nevertheless rules, guides and governs everything — and is not to be found out by *knowledge*, but by faith only. This first cause is synonymous with God, and here begins the province of religion, of the church, of the worship of God, which has nothing to do with science as such, and on which the investigator can wholly turn his back while searching into secondary causes. In this theory God does not, as he does in the German view, play in some measure the part of a stop-gap, but rather that of the sole ruler enthroned above the universe, who does not mix in the natural course of things, but is quite contented so long as his laws are in force everywhere and secondary causes are at work. This theory has the one great advantage that without touching upon or entirely banishing the idea of God, it yet makes it perfectly unnecessary for science and leaves men free to investigate natural laws without misgivings. Scientific men are thereby enabled to hold fast to their Christianity and yet to allow themselves the most perfect freedom of investigation within the province of science. It is true that a sound logic will never be able to admit that from the existence of the so-called secondary causes can be deduced the

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existence of a supernatural force or power independent of natural forces, which moreover never gives the smallest sign of its existence, and with which science has nothing to do. Credulous spirits or minds, who feel unable to manage without some spiritist fealty, may amuse themselves with the fancy that behind the impenetrable veil of phenomena a man stands with a rod in his hand, with which he will one fine day scourge all those who during their lives have not been sufficiently obedient slaves. But thinking and liberty-loving spirits will rather delight in the idea that the universe is in reality a *republic* rather than a *monarchy*, and that it is self-governed in accordance with eternal and immutable laws.

Wir haben lang genug geglaubt,
Wir wollen endlich wissen."

(Long enough have we believed; now we want to know.)*)

*) For further details see the author's "Natur und Geist," pp. 181—208.

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UNIVERSALITY OF NATURAL LAWS.

> The old myths disappear, and the isolation of natural phenomena ceases as we come to understand that a few great natural laws bind together and regulate all the diversities that exist in the universe.
>
> Girard.

> The spectroscope teaches us that everywhere the same material works in the same way, so that we can designate force and matter, supposing them not to be identical, as the corner-stones of the universe.
>
> N. Lockyer.

> The universality of terrestrial laws is above all doubt, as far as science is concerned.
>
> Dü Prel.

When the progress of astronomy had made it clear that sun, moon and stars are not lights fixed on the firmament for the purpose of giving light by night and by day to the dwelling places of the human race, but that they are bodies existing for themselves — when it became moreover apparent that the earth was not a footstool for the feet of God, but a dot or a speck in the universe, a star amid billions of other stars, to most of which it is very much inferior both in size and importance,*) the human mind, having

*) Among the billions of stars which fill the vast realms of space there are only *five*, or at the most *seven* (Mercury, Venus,

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been deprived of the chance of drawing fanciful pictures of things within easy reach, did not hesitate in giving all the more scope to its fancy in regard to things fare away from these. Distant regions were then invested with the glory of miracle and of paradise; remote planets or fixed stars were populated with races having ethereal bodies, exempt from the oppression of matter and from the natural laws that obtain with us. Those who had taught that this earthly life was a preparatory school for a better life elsewhere (without being able to explain why there should be such a preparatory school), hastened to open to their pious sheep a glorious boundless vista of a career, rising by schools and by classes, from planet to planet, from sun to sun, wherein the industrious and pious should be ever at the top, but the lazy and godless, as usual, always at the bottom. Even sober-minded men of learning did not scruple to allow a pretended "soul-substance" of the departed to pass from star to star with the swiftness of light, although they do not seem to have borne in mind that such journeys, despite the fabulous velocity of light, considering the enormous distances and the extreme cold of the ethereal space, must have taken up terribly long periods of time, spent with the least possible amount of comfort.*) However charming

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Moon, Mars, Jupiter, Saturn, Uranus), to whose inhabitants, if such there are, the existence of our earth would be recognisable, either with the naked eye or by the help of enormous telescopes. For the worlds of fixed stars, lying outside our planetary system, it stands to reason that it must be altogether unrecognizable.

*) Compare the chapter on "Innate Ideas".

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such progress from the fourth class to the third, from the third to the second and so on, may appear to minds inured to school discipline, a sober study of Nature, based on experience and observation, cannot acquiesce in these extravagant phantasies. In the present condition of our knowledge with respect to the worlds surrounding our earth, we can declare with perfect assurance that the same materials, the same forces, the same physical laws, with which we on this earth find ourselves moulded and surrounded, are found in the All which is visible to us, and that they are at work in all places in the same fashion and with the same inherent necessity as in our immediate proximity. Natural philosophy and astronomy have furnished us with complete proofs of this in sufficient number; astronomical science indeed could not exist as such, if the universality of terrestrial laws were not recognized.

Let us first consider *Gravitation*, that universal primal and fundamental force of Nature, by which are regulated the movements and the general mutual effects produced by all bodies in the universe upon each other. The laws by which these movements and effects take place, or the laws of motion and attraction, are invariable in all the realms of space into which the telescope peers and which are reached by calculation. The movements of all, even the most distant, bodies take place according to the same laws by which bodies thrown on our earth move, by which a stone falls, a cannon-ball flies, or a pendulum oscillates. When we see the countless atoms of dust dancing in our room in the light of the sun, their movement is governed (as Dü Prel remarks) by the

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same law which guides the movements of the stars in the furthest realms of space to which our eyes can reach by aid of the most powerful instrument — that is, by the law of gravity. All astronomical calculations respecting the most distant planets and their movements have been based on this known law, and they have proved correct. Everybody knows that by the aid of this calculation, astronomers foretell eclipses of the sun and of the moon, transits of planets etc. with unfailing certainty as to the day, hour and minute, and calculate hundreds of years in advance the appearances and re-appearances of comets, those well known knights-errant of space, having for their orbits now an ellipse, now a parabola, now a hyperbola; and they do so despite the many disturbances and irregularities to which the movements of these bodies are liable. Astronomers have even succeeded by calculations based wholly on the law of gravitation or rotation in determining the presence of stars which were only discovered by the telescope when it was known in which direction they were to be looked for. Thus, in the year 1846, the French astronomer *Leverrier* came on the track of *Neptune*, until then unseen by any telescope, in directing his attention to the disturbance shewn by the neighbouring planet Uranus in its orbit. When, in consequence of this, *Galle*, at Berlin, turned his telescope towards the specified place, he found the planet of which both the spot and the mass had been already determined. Just the same thing has happened within the last few years in the case of the intramercurial planet *Vulcan*, which has not yet been seen with complete certainty, but the existence of which is scientifically

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proved. But that which, more than everything else, proves that the laws of gravitation or attraction exist in the remotest regions of fixed stars, which are separated from us by many billions of miles, just the same as these laws are in force in our solar system or on our earth, is the study of the remarkable *double stars*, which have become better known only of late years. These are stars situated so close together that they can only be distinguished from each other by means of the most powerful instruments, and revolving around each other. In their singular movements they obey the law of gravity, as do the planets of our solar system. Thus, the presence of a second body near the splendid fixed star *Sirius* (α in Canis Major) now known to be a double star, was deduced from its peculiar movements on the basis of the law of gravitation, twenty years before *Clark* discovered the star itself at Boston, on Jan. 31. 1862. It had revealed its existence, thanks to our conviction of the universal force of gravitation, before ever a human eye had gazed upon it. "If anywhere" said the astronomer *M. W. Mayer*, "we have in this discovery the most conclusive argument in favour of the universality of attraction between masses in the universe." Indeed, the existence of these remarkable double stars shews that while in the fathomless depths of space the creative force of Nature seems to love to reveal itself in very much the same variety as here on our earth, yet it never, nor in any place, follows any laws unknown to us, or others than those to which it would have entrusted the building-up and the governance of the world. On the contrary, all these marvellous worlds have been evolved according

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to the same simple laws as those which built and rule our little earth.

Astronomers, confidently relying on the laws of gravitation, do not hesitate to authoritatively lay down the existence of *dark* or to our eyes imperceptible satellites of some of the fixed stars, e. g. Procyon, as the consequence of their peculiar movements.

It may also be remarked that the physical condition of all the planets whose proximity to our globe renders possible a sufficiently exact determination of their surfaces, is similar or analogous to that of our earth. Venus has high mountains; Mars has continents and seas, summer and winter. The moon has mountains, plains, valleys and volcanoes like the earth. All the planets of our system have seasons, days and nights as we have, although their relative lengths vary. Besides, they are all spherical in shape, like the earth; *i. e.* they bulge out at the equator and are flattened at the poles; like the earth, they are more or less inclined on their axes and have the double motion of rotation and translation; all these are signs of a similar origin. Hence the genesis of our globe yields us a sure analogy for the history of the origin and evolution of the other planets.

The laws of *light*, no less than those of gravitation, are the same throughout the universe and the same as on our earth. Light, whether solar or artificial, has throughout the same composition and the same velocity, and its refraction takes place everywhere in the same way. The light sent to us by the most distant fixed stars through a space of many billions of miles, is distinguishable in nothing from the light of our sun; it follows the same laws and

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is of the same composition. So little doubt is there among learned men on this head that the different coloring of the light proceeding from fixed stars enables them to decide with absolute certainty, on the one hand as to the temperature, condition and stage of development of these stars, on the other as to their individual and relative movements in space. Thus we are likewise in a position to determine according to terrestrial processes the areas of the umbræ and penumbræ arising from solar and lunar eclipses. Even the ring of the planet Saturn throws a shadow on it and receives in its turn a shadow from the planet. Lastly, the photographs taken of individual fixed stars prove that the light emitted by them contains, like sunlight, chemically active as well as luminous rays. The same remark applies to the heating rays, as has been shewn by very delicate instruments.

Like the laws of light, the laws of heat are the same throughout the universe, heat being the commonest and most widely distributed form of energy known to us, and being at this day universally regarded as merely another form of light. The heat coming to us from the sun or from the other fixed stars works exactly according to the same principles as the rays of heat do which are emitted by our earth or by the hot-springs found therein. On caloric circumstances depend the solidity, the fluidity, the gaseous condition of bodies; therefore these conditions must exist everywhere upon simular terms, so to speak. It has been shewn in a preceding chapter that the other forces of nature, such as electricity, magnetism, mechanical power, chemical

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affinity etc., are so closely bound up with caloric circumstances and stand to these in such intimate relationship, based upon reciprocal interchange, that they cannot be separated from one another; therefore must all these forces exist where warmth exists, that is to say, *everywhere*. This is especially true of the relation of heat to the form and manner of chemical combination and dissociation, which must necessarily proceed throughout the universe in a uniform manner, since the experiments carried on by the help of *spectral analysis* have proved to demonstration the universal distribution of chemical elements identical with those existing on our earth. But long before this most recent and most interesting method of investigation had become known, the same conclusion had been arrived at by the study of those visible and tangible messengers from another, non-terrestrial world, which we designate as meteorites or meteoric stones. Chemistry has not been able to discover a single element not present in our world in these remarkable bodies, the cosmic origin of which was for centuries regarded as a preposterous myth, while people on the other hand believed firmly and steadfastly in downright impossible things and events. These bodies are hurled to us from other worlds or from the primal ether, in all probability from the very depths of the space pertaining to the fixed stars, possibly as pieces or remnants of shattered planets or dissolved comets. Among the twenty-one elements or chemical groups found in these bodies up to the present time, there is not a single one alien to those of our own globe, and the substances predominant in them, such as iron, silicon, oxygen, are the very ones which also predominate on

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the surface of the earth. *Daubrée* has also discovered that the similarity that exists between these meteorites and the terrestrial minerals increases in proportion as we penetrate more deeply into the crust of the earth, and that several of the minerals found at the greatest depths (such as olivine, herzolite, serpentine) are in composition and condition almost identical with the meteorites; and lastly, that in closer proximity to the surface of the earth minerals are found which are formed of constituents similar to those of the meteorites, but oxidised (united with oxygen), and thereby having their mineral character changed. Daubrée further succeeded in artificially obtaining from terrestrial stones substances closely resembling meteorites. The investigation of meteorites has shewn moreover that the crystals distributed throughout their internal structure are formed according to the very laws of crystallisation which we recognise in terrestrial crystals, and that their forms in no wise differ from those known to us. Even the microscope, as *Moldenhauer* (Das Weltall und seine Entwicklung, I, p. 7) remarks, has not failed to render aid in this direction. "It appears in the structure of the meteorites, those little bodies that fall upon us from far-off unknown regions, that the internal construction of alien inorganic masses is essentially identical with that of our own."

These facts alone would be sufficient to prove that — in the words of Professor *Spiller* — "the unity of the forces of Nature extends to the very atoms of matter," and that "the formative force for each material and for each atom of matter is the same in the whole universe." But that which was

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only raised to high probability by the investigation of meteorites, has been made almost into a certainty by spectral analysis, that "language of light" as it has been rightly termed, the glance of which pierces through the chemical constitution of the most distant stars. Above all things it has taught us that the mass of the sun — and indeed nothing else could be expected from the fact of all the members of the solar system deriving their origin from the same primal mist — contains no other chemical elements in its ardent or incandescent integument than those which exist in our earth. These elements, as everyone knows, are sodium, iron, calcium, magnesium, chromium, nickel, barium, zinc, cobalt, manganese, titanium, aluminium, strontium, lead, copper, cadmium, cerium, uranium, potassium, vanadium, palladium, molybdenum, hydrogen, oxygen, nitrogen. There is still some doubt about the presence of a number of other known elements, such as indium, lithium, rubidium, cæsium, bismuth, tin, silver, beryllium, lanthanum, yttrium, iridium, silicon, sulphur, carbon etc. Probably all the metalloids (non-metals) are to be found in them; other heavy metals, such as gold, silver and mercury, may be present in the deeper parts of the sun or of its envelope, inaccessible to spectral analysis. The chemical composition of the solar envelope offers generally the greatest resemblance to, or analogy with, the chemical constitution of meteoric stones.*)

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*) It must not be forgotten that *one* material, or *one* substance has been discovered in the solar spectrum that corresponds with no terrestrial one, and which has therefore been named

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Of course, astronomers have not contented themselves with merely using the spectroscope — which is able to yield such positive data on the chemical composition of the most distant bodies — to investigate the sun, but, despite the great difficulties involved it has been turned also to account in the study of the planets, comets, fixed stars, nebulæ, falling stars, etc. The result has been materially the same throughout. These enquiries have proved the truth of the theory propagated by earlier astronomers, viz. that the so-called fixed stars are nothing but actual suns, in the atmospheres or luminous envelopes of which are found again in an incandescent condition those known bodies, some of which have already been mentioned, like iron, calcium, sodium, magnesium, tellurium, antimony, bismuth, mercury, hydrogen, nitrogen, etc. etc. Hydrogen appears to play the chief part in most of the fixed stars, and to cause the same violent eruptions and whirlwinds in them as it does in the sun. If *all* the substances found in the sun have not yet been shown to exist in the fixed stars, this probably results from the faintness of the spectra, arising from the immensity of the distances. The

helium. But according to the distinguished spectroscopist Norman *Lockyer*, helium is apparently nothing more than a modified form of hydrogen; and besides, Professor *Palmieri* of Naples states that he has lately discovered the helium line in the spectrum of the lava of Vesuvius. In point of fact it is very possible that an element the presence of which has not yet been discovered on the earth, may play an important part elsewhere, and on the other hand an element predominant with us may only be present to a slight extent in the composition of other stars. The general identity or unity of materials is therefore open to no doubt whatever.

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same remark applies to the yet more distant nebulæ or to those glowing masses of gas which astronomers regard as systems of worlds in course of evolution, and the spectra of which denote principally hydrogen and nitrogen. The comets have also been analysed by means of the spectroscope, notwithstanding the dimness of their light which renders accurate observation very difficult, and carbon und hydrogen have been discovered in them. Even falling stars have been submitted to the same analysis, and it is claimed that carbon, as well as glowing vapours of sodium and magnesium, have been discovered in them. It need hardly be mentioned that the light of the planet, being borrowed from the sun, must shew the same composition as that of the sun itself.

These discoveries form landmarks in the history of science and are worthy of being placed side by side with the greatest discoveries of all ages. They prove that matter is essentially identical not only within our solar system, but in the whole universe, down to the regions of the fixed stars and nebulæ. Now seeing that identity of substances must necessarily imply identity of forces, and that "the special form in which a substance produces its regular effect is the direct outcome of its chemical condition" (Dü Prel), no doubt can remain as to the similarity of materials and forces throughout the universe and as to the similarity of development in our solar system and in the most distant heaven of the fixed stars — a view which is now thoroughly accepted by all scientists who have concentrated their attentien on the study of this question. Professor *Kirchhoff* himself, the famous discoverer of spectral analysis, has

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stated his conviction "that the substances and forces in the whole universe are essentially the same."

All these facts and observations — with those already given at the beginning of the chapter — prove to demonstration the universality of natural laws, a phrase which is indeed but another expression for the regular working of matter and of its forces, arising from its chemical and physical nature, and these laws cannot therefore be confined to our globe, but must act in similar fashion throughout the entire known world. In no part of that space, boundless though it may be, is there a loophole left for imagination to bring one of its wild fancies into the world and to indulge in one of its dreams of some fabulous existence, subject to none of the ordinary limitations. The visible universe surrounding us is an infinite whole, composed of the same substances, borne by the same energies, swayed by the same immutable natural laws.*)

Oerstedt rightly maintained, in treating of the identity of mental and physical laws, that this universal application of the laws of Nature which are conceived by reason, presupposes also a fundamental equality of the conceptive faculty of the intellect

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*) Should the opinion of natural philosophers and chemists be confirmed — a view often expressed and becoming more and more probable — that in reality there is but one matter and there is but one force, and that what we term substances or forces are only different modifications or phenomena or conditions of the primary matter and the primary force, the proposition laid down above must become still more simplified. This subject is dwelt on at some greater length in Büchner's "Licht und Leben" pp. 69, 70, 191.

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throughout the universe. Should reasoning beings exist outside our planet — and this is probable enough, since it is difficult to see why the same or similar causes should not, under the same or similar conditions, produce the same or similar results everywhere — their thinking power must necessarily be the same as, or similar to, ours, although in degree or development it may vary to almost any extent. The principles of the physical development of man are also likely to be on the whole identical. So great, however, is the diversity of the individual worlds in point of mass, temperature, density, illumination, physical condition of the surface, etc. etc., and so far do the phases of development diverge from each other in the individual stars, that we have a perfect right to assume also the possibility of an endless diversity in the respective organisation of the inhabitants of each individual world. We know that adaptation to the surrounding conditions of life is one of the foremost factors in the formation and progressive development of organic beings, and the history of our own earth proves that relatively small differences in the physical condition of the surface of the globe, which have accrued in the course of geological periods or epochs, have been attended by the most radical changes in the fauna and flora of the earth; and from this we may infer that there exists an infinite variety of biological phenomena in the cosmos. In this respect, however, positive or scientific data are so entirely wanting that all further speculations on this topic should be cast aside as aimless and useless. One thing only, as we have said already, can be stated with comparative certainty, and it is that the iden-

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tity of cosmical substances and laws admits of the inference that the fundamental principles of physical and mental phenomena, of organic and inorganic life, must be the same everywhere; and that throughout the cosmos, wherever the material conditions are found for the genesis or evolution of living or organised beings, this genesis or evolution will take place with the same energy and abundance as it does in our earth. In the planets or moving stars especially, which on mechanical principles must accompany the fixed stars, or other suns, as our planets do our sun, though perhaps on a few of them only, the possibility of life at certain times and under certain circumstances must shew or have shewn itself very much as it has in this earth of ours; for "the formation of living matter denotes nothing but the setting-in of the effect when the given causes are sufficient." (Dü Prel.) As far as our own planetary system is concerned, it must be admitted that the circumstances conducive to the production of living and rational beings, similar to those on earth, are rather limited; for the period at which such a development becomes possible can only occur on the large or external planets when the sun shall have so far cooled down that it can no longer heat and light them sufficiently, and it is therefore quite possible that the conditions without which no production of a vigorous process of life can take place, are fulfilled on none but the so-called inner planets. The greater number of planets revolve as inert worlds round a central sun, which is only able to maintain life on some of them for a comparatively short time. On comets and meteorites it is obvious that no life is con-

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ceivable. The question has been propounded: May not the inhabitants of other planets be possibly endowed with a higher or richer organisation of their senses, and thereby be susceptible of impressions which we are not sensitive enough to receive? This possibility, supported as it is by the fact that the mental powers of man can only be regarded as the gradually developed result of a process of life that is adapted to its surroundings, may well be admitted without in any way affecting the general results laid down in the foregoing.

"And if," says *Zeise* (Das Endlose der grossen und der kleinen materiellen Welt, Altona, 1855), "as there is not the least reason to doubt, more highly organised living beings exist in remote worlds, these would yet, in their superior development as rational beings, undoubtedly resemble the earth-man in regard to intellect, since in the whole universe only *one* intelligence can be imagined which is the same everywhere — an intelligence which makes all physical laws appear as intellectual laws."

"In the life of the mind," says *Ph. Spiller* (Die Urkraft des Weltalls, 1876), "there must eventually be some features of absolute unity, despite the diversity that may exist in its organisation. *The laws of thinking are no doubt the same throughout the universe.*"

That mind and nature must, in the last resort, be the same, that physical and mental laws must be identical, is essentially involved in what has been said in preceding chapters as to the relations between matter, force and movement. Could it be otherwise, considering that Nature's laws themselves have created

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the mind and that the same forces are at work in it which rule the world and Nature? Hence the laws of thought of our minds must be in unison with the most recondite principles of the laws governing in Nature, and hence the laws of thought are also the laws of the universe. The laws of thought themselves must therefore be looked upon as pure natural laws and as the result of a development that accrues from the laws of nature and from natural history. Human reason or mental activity is in some measure as the mirror which reflects the All, it has gradually proceeded from that unbroken interaction which goes on between the organism and its environment during cosmical and geological periods. Beginning at the lowest step of sensibility or of capacity for sensation, the human as well as the animal mind has raised itself gradually, through countless stages of action and reaction, to its present height, and in doing so has acquired those well-known forms of thought, which in the eyes of those who are unable to appreciate the principle of evolution in its full strength, appear erroneously as innate ideas preceding all experience.

"The fulcrum of the argument," says *Oerstedt*, "that the laws of nature are laws of intelligence, lies in the fact that from laws of nature known to us we are enabled by thought to deduce others which experience brings again before us, and that, when this does not happen, we find in the regular course that we have blundered in our inferences. Hence it follows that the laws of thought by which we draw inferences apply also to Nature itself."

"The laws of thought flowing from the human brain," says *Ph. Spiller* (*loc. cit.*), "have no logic

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other than that which is to be found in the laws of the Universe. Conscious human mathematical reasoning is none other in essence than unconscious physical thought. It results also herefrom that logically thinking heads, far away from one another, have discovered this almost at the same time."

Paul von Lilienfeld expresses this same thought with even greater force in the following words: "The necessary laws of thought and of matter are one and the same. Thought is a condensed motion, and since the human organism is but an involution of physical forces, thought must also be regarded as merely the condensed action of physical forces."

This theory agrees of necessity to the fullest extent with those results of the empirico-philosophical conception of Nature which we shall deal with in a subsequent chapter on innate ideas and on the gradual mode of evolution of human and brute intelligence. Knowing nothing of so-called absolute and superhuman ideas or conceptions implanted into it by a supreme power, but deriving all knowledge, thought, sensation and volition from the millionfold repeated impressions of the surrounding world, the laws prevailing in the latter cannot but be reflected or reproduced in some measure in the former; or, as *Carus Sterne* expresses it, the human mind is nothing but a more or less faithful lens which brings to a focus the rays of knowledge dispersed throughout Nature. Although it may be difficult or impossible to disentangle or lay bare in each individual instance the manifold interwoven threads of these relationships, yet no doubt appears to us to rest on the matter as a whole.

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"Dieselbe Ordnung waltet überall:
Im wechselvollen Reigen der Gestirne
Gebietet das Gesetz nach Mass und Zahl,
Wie in des Menschen denkendem Gehirne."
(F. Krasser.)*)

(The same order rules everywhere; the law of measure and number rules in the changeful hosts of the stars as it does in man's thinking brain.)

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*) Further details on the questions touched on in this chapter will be found in the two first essays of the author's work, "Licht und Leben"; also in "Natur und Geist" in the section on Natural Laws, and finally at the end of "Die Macht der Vererbung."

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THE HEAVENS.

The conception of "heaven" as a definite spot in space can be looked upon by science as nothing but a procreation of empty heads.

Ph. Spiller.

The idea of an Almighty Power which acted as an impulse at a definite moment, is so antagonistic to all our notions of the working of physical forces, that we can give to such a possibility no right of citizenship within science.

A. Bernstein.

The thought of a bodiless force hovering over the chaos of the elements as a creative spirit belongs to the dreams of visionaries.

E. Harless.

Every schoolboy knows to-day that the heaven is no blue vault suspended over the earth, with holes in it through which the fiery sphere of the universe gleams in the shape of sun and stars, but that, in looking at it we are gazing into an incommensurable and almost empty space without beginning and without end, the vast desert of which is interrupted only by single stars or groups of stars, few in number and infinitely far between, and in which e. g. our own solar system, despite its gigantic extent, appears as a mere dot in the infinitude of space. Therefore, if the religious theory of the universe teaches

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us that after the conclusion of our earthly career we are destined to "go to heaven", astronomical science informs us on the contrary that we are already in this dreamed-of heaven, surrounded in the far distance by countless worlds and world-systems similar to our earth or our solar system. Out of more or less formless masses of vapor or mist — spread originally over many billions of miles, the constituent materials of which must have been of a rarity far beyond our conception — individual rotating points must have issued, in which the atoms drew more closely together, and thence these worlds and world-systems must have evolved by a process of condensation increasing step by step, and have gradually rolled themselves together in compact masses or organised systems. These masses are constantly both in individual and reciprocal motion in space; this motion is obviously combined and complicated in the most diverse ways, yet controlled in all its phenomena and modifications by a single natural law of which we had spoken heretofore and which applies everywhere viz. the law of gravitation or attraction. All the large or small worlds without exception, and without the very slightest deviation that could by any possibility be regarded as being in contradiction to the simple mechanical principles of their motion, follow this perhaps most important and most widely diffused of all natural laws, to which every substance is subject, and which can be observed directly in every individual body and in every particle of a body. Such a contradiction or such an exception must be regarded as an absolute impossibility, and the existence of a fact in opposition to that law would be a miracle as great as

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any other physical miracle. In reality no such exception nor deviation, pointing to the working of an extramundane power or of an arbitrarily ruling or governing hand, could ever be scientifically demonstrated. On the contrary it has been shewn that all such motions, so far as they are not affected by interruptions that are beyond computation, can be ascertained, determined and foretold with mathematical accuracy and certainty. As far as the telescope reaches and as far as man was able to espy the laws of the heavens — and this has been done to the extent of billions and trillions of miles — he has met everywhere with the same law, the same simple, mechanical principles, the same mathematical formula, and the same phenomena that are subject to computation. But never has been found the slightest trace of an arbitrary finger, ordaining the spheres of the heavens and appointing the courses of the earths, the suns and the comets. "I have searched through the heavens," said *Lalande*, the great astronomer, "and nowhere have I found a trace of God." And when the Emperor Napoleon asked the celebrated astronomer *Laplace*, why not a word was said of God in his "Mécanique céleste," the latter answered: "Sire, je n'avais pas besoin de cette hypothèse." The further astronomy advanced in the knowledge of the laws and phenomena of the heavens, the further it repelled the idea or hypothesis of a supernatural cause, and the easier it became to trace back the origin, grouping and motions of the heavenly bodies to the simplest possible phenomena induced by matter and by the laws of its motion. The mutual attraction of the smallest particles rolled the worlds together, and the laws of attraction with their primal

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motion gave rise to that system of reciprocal revolution which we now perceive in them. Many indeed who have reached this point, refuse to look for that initial impulse in matter itself, preferring to trace it to the touch of some supernatural finger which is supposed in some fashion to have stirred the general inchoate world-materials and imparted motion to matter. Thus even the great *Newton* pretended to see the finger of God in the tangential or lateral motion of the stars; and *Laplace* himself could not refrain from exclaiming: — "O philosopher, shew me the hand which has thrown the planets on the tangents of their orbits!"

But even in such a remote position, personal creative force cannot hold its own. The principle, demonstrated in a former chapter, that there is no matter without motion, and that eternal matter implies eternal motion, is in itself sufficient to put an end to this difficulty. There can be no doubt that throughout space motion has existed from all eternity and will exist for evermore, that all bodies without exception are subject to a regular succession of origin and decay, and that each traverses a cycle of origin, existence and death, which occupies enormous periods of time, and eventually melting away again into the so-called cosmic mist, re-enacts the old game either in the same or in a similar fashion. Thus it happens that an eternal and eternally existing change takes place throughout the space of the universe.

But even apart from this general principle, it is by no means impossible or even difficult to conceive the manner in which that particular kind of motion

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took place which gave, or must have given, the primal impulse to the process of globular aggregation referred to. The very slightest dissimilarity of size or of attractive force or of the relative positions of the atoms in the primal state would have been sufficient to induce the origin of the first centres of condensation. The necessary contraction of the incipient ball of mist by cooling, or by irregular radiation into the cold space around it, must have sufficed to draw the atoms together in different ways and thereby initiate in certain places the process of condensation and motion which would eventually lead to the formation of individual bodies. It may be that there was a lateral attraction from neighbouring bodies at work, which produced in some portions of the ball of mist increased condensation and agglomeration in that one direction and eventually caused it to rotate on its own axis. Possibly there were also chemical affinities at play, inducing certain atoms, after the cause of the original dispersion had ceased to act, to draw near to one another and form new substances, in such a manner that the larger, overpowering the smaller ones that surrounded them, attracted these towards themselves and thus gave rise to further chemical processes, favored by the higher temperature resulting from the increase of density. By the irregular accumulation of larger or smaller masses coming from different sides a displacement of the centre of gravity became inevitable. Hence currents set in within the various parts of the sphere of gas, and these eventually resulted in a rotatory movement which led to the formation of individual spheres moving in regular orbits. In point of

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fact, the telescope has revealed to us the existence in the sky of such rotating mists, or spheres of mist of annular spiral form. The whole build of the so-called spiral mist-masses goes to shew that those remarkable bodies are in a state of revolution, in the course of which enormous currents of incandescent matter descend in spiral lines upon the central masses, producing, in doing so, whirling and circling movements, which eventually lead to the formation of spherical planets. Besides, this rotatory or revolving motion exists so generally throughout space and is so universally perceptible among all aggregated cosmic masses as to clarly point to the presence of some universal cause, that is to say, of some physical necessity. According to *Spiller*, there exists in reality no rectilinear but only a curvilinear motion in space. The velocity of this motion must obviously increase in proportion to the increase of the density of the cosmic mass.

The further development of this revolving cosmic mass into articulated solar and planetary systems also proceeds on purely mechanical principles and in accordance with known physical laws. Acceleration of the velocity of the induced motion by curtailment and contraction — a lens-like flattening of the aggregated sphere of mist with a greater condensation at the centre — the separation of equatorial zones of vapor by vibration or centrifugal force, like that which is still to be found in the case of the planet Saturn — these zones finally broken up and the separated portions rolling into spheres (planets, moons etc.) — gradual cooling down of these separated bodies to various degrees — all this in accordance

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with Kant and Laplace's famous and now universally accepted nebular hypothesis — these are the simple means by the aid of which Nature has obtained and still goes on obtaining her great aims of world-formation, which are computed to the extent of myriads of years. For even now astronomers, starting from the most solid foundation, see in the so-called nebulæ in the heavens the various stages of development of our own solar system or revolving worlds arising from wide-spread masses of mist, which will gradually, by increasing condensation and rotation, develope into various planetary or solar systems. "Who," says Professor *Forster* ("The Beginning and End of the World" p. 18), "can see the so-called spiral or whirling mists without the conviction of their inherent motion at once forcing itself upon him?"

There are indeed many *nebulæ* in the sky which are merely groups of stars and which can be resolved into such by the observer with the help of powerful instruments. Then again there are others, essentially different from these, which cannot be resolved into separate stars and which clearly consist of cosmic or primal world-masses in different stages of development. Some of these have nuclei, which have already separated themselves from the whole mass in the shape of more solid centres; others have annular forms, and so on; by comparison of earlier and later observations of the same nebulæ it has even been possible to recognize certain changes that have been going on in them. A great number of these nebulæ appear to have a double motion, resembling that of our sun and of its planets, and are likely to develope like these in the end. Nay, there are actually criteria which

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go to shew that even within the limits of our own planetary system there are remnants of that mass of mist from which that system must originally have sprung. More recent searches into the analysis of light have fully confirmed and proved the theory of the primal world-mist, put forth by Herschel and Laplace, and have shewn that there exist in the space genuine mists endowed with inherent luminous properties and being nothing more than glowing masses of gas. The only force which lies at the base of all these formative processes and movements is nought but attraction — attraction, which condenses the mists, which forms suns and planets out of them, which regulates their movements and finally evolves from the induced condensation heat and light, the sole and ultimate source of all phenomena of life.

All these observations and facts give us the right to conclude, judging from analogy with that which has been already discovered, that certain phenomena which take place in the heavens and the explanation of which is still more or less wanting, do not represent exceptions to the general laws of Nature, and that the cause of their peculiar kind of motion lies either in themselves or in the ordinary laws of matter. We are all the more justified in doing this, if we bear in mind that there are so many irregularities and so many things more or less fortuitous, nay, looking at them from the point of view of design, actually aimless or inexpedient in the order of the universe and of its individual organs, which go dead against the theory of the working or interference of a higher intelligence or creative power, analogous to the laws of the human mind. If, as must be assumed accord-

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ing to the teleological idea of the world, a personal creative power, guided by definite aims, meant to create worlds as dwelling-places for intelligent thinking beings worshipping his omnipotence, why should there be these huge, vacant and useless tracts of space, in which but here and there isolated suns and earths swim as almost imperceptible dots — resembling a handful of globules thrown into the vast ocean?*) Why then are not the other planets of our solar system (with perhaps the solitary exception of the planet Mars) adapted to be likewise inhabited by men or by man-like beings? Would not the formation of many smaller planets have been much more calculated to secure the objects of life, seeing that, as shewn heretofore, the so-called outer or larger planets are in no way suited for ever developing life? Why is the moon, our everlasting companion, with its craters and burnt-out volcanoes, left without water and without atmosphere, and therefore inimical to all organic development?**) Why is not the sun, the sur-

*) The famous astronomer *Tycho* de Brahé, who died in the year 1608, "put the place of the fixed stars as not far beyond the orbit of Saturn, the outermost planet according to the knowledge of his time; for the idea of wide starless tracts of ether would not have agreed with his conception of a creator pervading all space." (F. Nobbe.)

**) According to more recent views the moon is really thought to have an atmosphere, but one of such rarity that its density is only from 1-200th to 1-400th of that of the earth, so that it must be quite unfit for the existence of animals, plants, or human beings. The other physical conditions of the moon's surface are also such as to make it absolutely impossible for the moon to be inhabited. According to *Nasmyth* the surface of the moon, which is now known to us with perfect accuracy, offers

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face of which is 12,500 times greater than that of the earth, inhabitable as it was once thought to be? and why are the fixed stars, scattered through space in incalculable millions, in a similar condition? If it should be said that these suns serve to enlighten and to warm their inhabited planets, then must it not be forgotten that in this case the means and the end stand in a most startling contrast to one another and that our own sun, for instance, the centre of our planetary system, is constantly squandering uselessly huge quantities of light and heat in the cold realms of space, while our little earth, the supposed centre of the universe, receives of all this but the 2300-millionth part or even less, and the whole of the planets between them are benefited to only the 230-millionth part of this enormous waste of force. Nay, what is the object, from a teleological view, of the change of day and night, which necessarily results from the relation of the sun and earth? If such a change is necessary for the life of the creatures inhabiting the

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nothing but a desolate waste, a terrible desert which no human imagination can realize, and in which life resembling that of our terrestrial home, with perhaps the exception of certain minute forms, is quite impossible or inconceivable. A fearful heat reigns close to the ground during the day, which lasts 336 hours, and a frightful cold beyond the ground and during the equally long night. There are to be found but crude forms, dead materials and the soundless play of mighty forces! Wherefore this great development of energy without any visible aim of life? For as a mere illuminant of our nights the moon clearly fulfils its duty but very imperfectly, for it changes, and over and above this it may be the cause of terrible earthquakes. Besides, the question why the moon should always turn the same side to the earth, is utterly unanswerable from a teleological standpoint.

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earth, why should the polar zone have a day and a night lasting each six months, and why should the necessary darkness of the night be broken by the influx of moonlight?

In the well-known inclination of the axis of the earth towards the plane of its orbit, known by the name of the angle of the ecliptic, which is the cause of the change of the seasons, many perceive a design of heaven intended for our welfare. But they do not consider that they are confounding effect and cause, and that our organisation would most probably be different were the inclination of the ecliptic different or non-existent. Besides, this very angle of the ecliptic, the object of such mistaken praise, does not even seem to be in any way conducive to our advantage; and if it were in our power to change this slope of the axis of the earth towards the plan of the earth's orbit, we should most certainly do it and thereby bring about a greater equality in the seasons. For if the earth's axis were perpendicular to its orbit, there would be in our latitude, for instance, a perpetual spring, calculated in all probability to lengthen human life.

Why — we must ask still further — did the sun shew its beauty to the earth day by day, why did the moon shed its silvery beams over the world, why did the glorious stars and constellations shine in radiant beauty on it during those endless ages of the past in which no creature existed on its surface to turn these glorious arrangements to account, to admire them and meditate on their object? What is the meaning of the irregularities and of the striking differences in the size and distances of the individual

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members of our solar system, and why is there an absence here of all order, symmetry or harmony, beauty, regularity, law, in regard to size, density, position, habitability, etc.? Why have all the comparisons, analogies, speculations, founded on the number and formation of the planets, such as the great *Kepler* earnestly engaged in, proved to be mere idle phantasies? What is the object of the so-called asteroids, or smaller planets, with their orbits crossing each other, of which considerably more than two hundred are known at this day, although it is not very long since rambling philosophers thought that they could demonstrate on speculative grounds that no further planets could exist in the recognised astronomical gap between Mars and Jupiter? What duties do the countless meteors or meteorites discharge which cross the earth's orbit and do so much mischief in their descent? or the innumerable comets with their ever-changing paths, which only seem to exist for the purpose of aiding and abetting in the worst kind of superstition, and of which, to use Kepler's phrase, the heavens are as full as the sea is of fishes? or those thousands of suns without planets, the so-called twin-stars, which revolve eternally round each other or round a common centre? Finally, why is our planetary system so arranged that, having originated in time, it must perish in time, and with it all that is great, all that man has ever accomplished or ever done on earth, must subside again into the limbo of eternal oblivion?*) .

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*) According to the most modern views of astronomers, which are strongly supported by the discoveries made by the help of

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If — as the theists make out — the world or the cosmos were created or governed by an eternal reason, or as they are wont to say, designed by intelligence, how can all these contradictory facts be explained? and why did not the eternal reason give the planetary systems an order from which its object and meaning could be recognised without any doubt? Why did not the everlasting creative power write his name in starry letters in the heavens, and thus put an end to all those doubts that torture and trouble the human breast, to all those endless controversies about his own existence, which have caused so much pain and grief to poor humanity, groping for ever in darkness? Why should he hide himself from us and lay snares for our reason, which inveigle us into endless doubtings and discomfort of every sort? How could God, if he existed, quietly witness all the sad results of this uncertainty about his own existence, seeing that he could so easily put an end to them?

These thoughts, these questions and strictures might be multiplied *ad infinitum;* but multiplying them would change nothing in the result, that no unprejudiced investigation of Nature, wherever it may search, can discover any trace of a supernatural influence either in space or in time. The renowned "harmony of the universe" rests, as has been shewn already,

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spectral analysis, all solar and planetary systems pass through a life-cycle of origin, existence and decay, occupying thousands of millions of years, and reiterating itself eventually in the same or in a similar manner by renewed decomposition into cosmic mist (primal world mist). Throughout all space a perennial change is going on and has gone on from eternity. Cf. the author's work "Licht und Leben," pp. 211—223, and LVI.

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partly on imagination or ignorance, partly on the same causes by which, as will be more fully explained in subsequent chapters, the apparent design in other natural phenomena, especialy in the organic forms living on our earth, is brought about; and if, without prejudice to the views stated above, a certain order and regularity must be recognised in the phenomena of the sky, such order is but the necessary and unavoidable result of the processes of evolution in the heaven itself, which could never have existed as such without such order. For a chaos, which in the course of ages is neither developed nor decomposed, must ever remain a chaos, while a movement once begun must necessarily in the course of immense periods of time, and by the gradual excision of all that is incapable of life or unsuitable, as also by reciprocal adaptation of individual beings, give rise to the genesis or survival of such forms as are suited for their surroundings and therefore capable of life or suitable therefor. When the unsuitable has perished long since, the suitable remains. Therefore, the suitable movement or position of any individual heavenly body is but an individual instance of movement, and all movements of such a body which are unsuitable or which collide with the movements or positions of other heavenly bodies must be gradually eliminated or cut off, until those only remain which do not bring about their own destruction by irregularity or incompatibility with a definite order; so that in the end the whole vaunted beauty and order of the universe amount to nothing but the mechanical relation of physical forces. In a most ingenious work entitled "Kampf um's Dasein am Himmel" ("Struggle

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for existence in the heavens") — Berlin, 1874; third revised edition, Leipzig, 1882 — Dr. Karl Freiherr Dü Prel first and very successfully sought to apply to the astronomical world the Darwinian principles which have in modern times become the standard for judging the organic world. According to him, the apparent design in the arrangement of our planetary system is merely the result of a very long process of evolution, and is to be regarded as the simple outcome of the fact that all planets which did not follow regular orbits, left the system, or re-united themselves to the sun, or were flung off into long-stretched paths along which they subsequently travelled as comets and groups of meteorites. It is probable that the sun originally possessed a much larger number of satellites, many of which were eliminated in this manner; this possibly accounts for the great gaps that exist in the system. Only in the group of asteroids does this process of elimination appear to be still incomplete, since this group, being a portion or broken-up fragment of some planet, shattered to pieces by some cause unknown to us, has not been as long in existence as the remaining planets. In the case of the comets also, which must be regarded as a direct offspring of the sun, Dü Prel holds that this process is as yet far from being complete. He regards them as the youngest members of the system, while the planets are the oldest and the asteroids lie midway between the two classes. But everything in this (and other) classes that is incapable of fitting into the general system and into the order that reigns in it to a certain extent, must, in process of time, be eliminated or crowded out. "Thus the physical struggle which commenced

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by the law of gravitation, ends with those marvellous combinations of mighty stars, at the sight of which we can scarcely forbear from coming to the conclusion that their movements must from the very first have been regulated by an all-wise design. And yet we can only attribute this orderly result to the aimless working of physical forces, which here, as everywhere, act according to the principle of adaptation and must infallibly evolve harmony in the end."

None the less this harmony is by no means complete, despite the great regularity of the movements in our solar system. One planet keeps constantly pulling at the other and striving with more or less success to influence its course. The moon drags at its mother-planet whose oceans it often raises up to devastating tides and whose intestines, if a modern theory be true, it stirs up to destructive commotion. Comets and meteorites drive their path right across the system, bestowing no benefit on it, but only injuring it. The supreme force of the sun alone keeps the whole system in tolerable order.

We close this chapter with the same words with which Dü Prel concludes the preface of his interesting work: "Epicurus of old said: The Gods dwell in the interspaces of our knowledge of the world."

"Nie hat der Geist des Menschen mehr geglänzt,
Als da er unbekannte Welten mass,
Da er in jenen Höhen, unbegrenzt,
So wie in einem offnen Buche las.
Den Himmel hat er zu sich hergezogen,
Den Schleier aufgehoben von den Fernen,
Und wenn sein Geist ihm überall gelogen,
Dort fand er ew'ge Wahrheit in den Sternen."

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("Never has man's spirit shone more brilliantly than in measuring unknown worlds and in reading, as in an open book, those illimitable heights. He has drawn the heavens down to himself, he has lifted the veil from the distant, and if his spirit deceived him everywhere, he yet found eternal truth in the stars.")

(J. F. Castelli.)

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PERIODS OF THE CREATION OF THE EARTH.

Modern geology has shewn that none of the so-called geological formations are spread over the whole earth, but that all formations have taken place simultaneously at every period; it has also shewn that they are still progressing all over the world and will continue to be progress for ever.

F. Mohr.

Things happening to-day are merely the copy and reflex of the things that happened in former times.

Isnard.

The forces now at work in the world are the same in quality and quantity which brought about geological changes in the most distant ages.

Lyell.

In the time-piece of Nature thousands of years are but a single beat of the pendulum; they are but what a second is to us.

H. Tuttle.

After the earth had separated itself as an individual self-existent body from the rotating primal mist and begun its rotatory motion around the remaining central mass, a number of changes began in its interior which tended to produce a continually increasing condensation of its mass in the centre and a simultaneous refrigeration on the outside. Whereas the ancients, in their imperfect cosmogony, taking

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the earth for the centre of the universe, fancied that in the course of the supposed division of the solid from the liquid, the fire rose to heaven in order to form the radiance and glow of the firmament, it in reality receded slowly deeper and deeper into the bosom of the earth, and now betrays its presence only by the ever increasing heat of the interior of the earth, by hot springs, volcanoes, etc. The outside of the earth, on the contrary, becoming more rigid and forming a crust, assumed more and more the characteristics of apparent solidity and immutability which it has at this day. Fierce conflicts took place between fire and water, after the water had precipitated itself on the surface of the earth as a hot primal ocean from the watery mist surrounding the globe, and had uniformly spread over its surface. Out of these conflicts, and by virtue of influences destructive on the one hand, constructive on the other, of forces partly physical, partly chemical, partly representing the working of inferior organisms, there arose, in the course of enormous periods of time, earth-formations and strata which are accessible to our investigations, and in which geologists read the history of the earth as in an ancient chronicle. The day-book of Nature, it is true, is not so complete and uniform as to require merely to be read off; on the contrary, it is in the highest degree imperfect, full of gaps, continually interrupted, and written in many different spots all over the surface of the earth; its leaves are in many ways damaged or put out of order by subsequent events; individual letters are destroyed or rendered illegible, so that it needs no little trouble and no little keenness to fill up the gaps, to some extent, to interpret accurately

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the obliterated passages and to get at their true connexion.

Indeed, such an interpretation would probably have been impossible, if scattered solid fragments and remains of the earlier world of living organisms, such as mussels, teeth, scales, bones, feathers, shells, plants, etc. — the so-called fossils — had not resisted destruction, and had not, by giving to each geological formation a definite and easily recognizable character, served in some measure as guides or clues through the labyrinth of that geological chronicle. This circumstance, in connection with erroneously interpreted geological facts, unfortunately gave rise to the famous theory of geological catastrophes and revolutions which, for a length of time, ruled supreme in science. As an outcome of this theory, it was imagined that from time to time a complete change was caused in the surface of the earth by gigantic revolutions and catastrophes, accompanied by the destruction and subsequent new creation of all living things to be found thereon, and that this proceeding had been repeated some thirty or fifty times in the history of the earth. Fire and water, each after its fashion, were supposed to have co-operated in destroying the world of living things at a blow, and to have afforded the creator, after the elements had quieted down again, an opportunity of setting to work his creative omnipotence in establishing a new order of things. The names of the famous French scientists *Buffon* (1707—1788) and *Cuvier* (1769—1832) are most closely connected with this theory of cataclysms; it was also believed in by the famous naturalist Agassiz, who died a few years ago, and it still musters numerous adherents,

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though rather in theological than in specially scientific circles. The greater number of the ancient philosophers, like Heraclitus, Plato etc., also looked upon the history of the globe in a similar fashion and had an idea of periodical catastrophes and new creations of the world, recurring at intervals of a larger or smaller number of thousands of years; whilst others, whose tendency was more of a materialistic nature, such as Anaxagoras, Okellus, Democritus, and his disciples Epicure and Lucretius, even then expressed an opinion that the cosmic process ever followed its regular course and that the violent changes were confined within very narrow limits.

This theory of catastrophes, as will be easily seen, afforded the theological tendency in natural science a welcome pretext for calling in the co-operation of a supernatural power, by whose impulse or permission those revolutions were thought to have been brought about, in order that the earth might be led through various stages of gradual improvement to a form suited for certain objects or designs. It was supposed that this power had intervened frequently and directly, or that a continual and new creation had taken place, at stated periods, and that new and improved organic beings and species had sprung up after each successive destruction. The Bible was thus borne out when it said that God had visited the earth with a deluge in order to destroy the disobedient human race, wallowing in iniquity, so that he might put a better one in its place. God was thought with his own hand to have raised mountains, dried up oceans, created living things, and so on. All these fancies about the intervention of an

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independent, supernatural, and mysterious power in the course of the earth's history have turned out to be mere illusions and dreams, when looked at by the light of sober scientific thought. With the same keenness of vision, with which astronomical science pierced through and discovered the conditions of the furthest realms of space, the eye of geological science ranged backwards over a past of millions upon millions of years, the unlifted veil of which had hidden the history of our globe from man's ken in a mysterious gloom which readily lent itself to superstitious *rêverie;* and, in so doing, it discovered the clearest evidence of the fact that this history owes its existence throughout to none but the simplest and most natural processes, which may in many instances be traced with the greatest scientific accuracy. The theory of the so-called periods of creation of the earth, which in former days were so frequently and so readily spoken of, and which even at this day a cosmogony based on childish error would feign identify with the biblical days of creation, — was found to be altogether inadmissible, and the whole past of the earth appeared as the present of our globe, unrolled. It is the great glory of the eminent English geologist Sir *Charles Lyell,* who died only a few years ago, to have been the first who proved convincingly that the catastrophes or revolutions, on which had been built up the theory of the periods of creation, were never universal, but purely local, in point of fact that no geological convulsions had taken place simultaneously over the whole surface of the globe, but that the past history of the earth is only a continuous and gradual process of evolution, springing from the same

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forces, phenomena, and diminutive changes which are actively at work at the present time in the formation of the surface of the earth, and which day by day keep going on under our very eyes. It is true that this process generally goes on in such a slow, gradual, imperceptible manner, that the spell of time allotted to our observation and experience is much too short for us to acquaint ourselves with the great results of its working. No doubt it must at first sight have appeared as though the changes of which we see such powerful traces on the surface of the earth, must have originated in powerful and violent convulsions of its interior; but riper experience and observation teach us the very opposite. "For the earth", says *Burmeister* in his excellent "History of Creation", "is entirely formed by forces which we find active in their full strength even at this day: it has never been subjected to evolutionary catastrophes essentially more powerful or entirely different from those which affect it now; on the other hand, the length of time in which the changes have taken place is immeasurable. . . . . The gigantic and startling nature of the terrestrial evolution lies only in the huge periods of time during which it has been proceeding" etc.

In fact, the main solution of the apparent enigma lies in the enormous periods of time through which the history of the earth extends. As a drop of water ever falling on the same spot will in time perforate a stone, so forces apparently weak and scarcely perceptible on a small scale produce incredible and seemingly miraculous results when working through long periods. Now, as formerly, the earth

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is constantly changing under our very eyes; constantly terrestrial strata appear and disappear, volcanoes are ignited, earthquakes rend the ground, mountains rise or collapse, whole continents are levelled up or slowly recede again into the bosom of the earth, islands rise and sink, the sea retreats from the terra firma or overflows other lands, rivers change their courses, now tearing away tracts of land, now laying down fresh soil on other spots; to this very day, the countless myriads of plants and animals are still actively engaged in gradually building up the crust of the earth, while water, wind, and storms seek to pull down again what has been built up.*) All these slow and natural effects produced by natural causes at different times and in different places, which effects have needed so many millions of years to evolve themselves, we now behold united into one grand collective picture, and so striking and powerful is the impression wrought upon us by this picture, that we are driven, as it were, to the thought of, or the belief in, a ceaselessly creating power; whereas in reality everything has occurred in the most natural fashion, as the necessary sequence of cause and effect. No doubt, the difference between the individual geological formations is very great, so great, indeed, that they cannot directly depend on

*) Any one who wishes to acquaint himself with the practical evidence of these facts, can find it in the following works: Burmeister, "Geschichte der Schöpfung"; Rossmässler, "Geschichte der Erde"; O. Vogler, "Erde und Ewigkeit"; F. Mohr, "Geschichte der Erde"; Lyell, "Principles of Geology", and "Antiquity of Man"; lastly, in the author's works, "Natur und Geist" p. 223 *et seq.*, and "Die Darwin'sche Theorie", Second lecture.

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each other, but must have been separated by protracted geological periods. In taking up a diagram of the strata of the surface of the earth, one notices at the first glance that rocks of such various structure and mineralogical composition cannot be the result of a closely connected formative process, but that long pauses must have intervened, in the course of which important geological changes, upheavals and subsidences, alterations of oceanic currents, differences of sedimentary deposits, etc., must have taken place. During the upheavals the waves also began to carry on their process of destruction, so that whole tracts of land with the organisms embedded in them were washed away again, and the whole geological and paleontological record must necessarily have suffered a complete break in that particular spot. To those who look only at the surface of things and who have no understanding of the intimate connection of things, this break may appear as real and as a proof of a new creation having taken place; but the rational and enlightened mind of an educated man, aided by scientific training, will judge very differently indeed. It knows that the investigation into the history and the stages of development of the earth, like the investigation into the laws of the heavens, is unable to find anywhere the traces or the workings of a supernatural power, holding a position independent of the natural connection of things; that investigation has, on the contrary, proved that everywhere and in all periods of that history the same materials, forces and physical laws were active as those by which we are now surrounded. Nowhere, nor in the remotest periods of the past, has this investigation found a

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spot which, when reached, it became necessary to put a stop to scientific research or to accept the notion of unknown or supernatural forces; everywhere have been found the same laws, the same matter, the same processes accessible to scientific analysis. "Historical research (into the history of the evolution of the earth) has led to the conclusion that the past and the present rest on exactly similar bases; that the past developed in a fashion identical to that in which the present rolls on, and that the forces which are active on our earth have been the same from time immemorial." (Burmeister.) "This immutable identity in the nature of phenomena gives us a certainty that fire and water have had the same energies at all periods as they have now and will have henceforth; that gravitation, and hence the phenomena of weight, electricity, magnetism, and the volcanic activity of the interior of the earth, have never been different from what they are now." (Rossmässler.) "Nature almost always works in dumb silence; cataclysmic convulsions and violent destruction are but exceptional. The catastrophes which authors have crudely painted from fancy, are either exaggerations or have never taken place at all. There have been great changes, and vast upheavals; but for the most part with less tumult than fanciful authors have made about them, *and they have certainly not taken place by means of any but the normal and known forces of nature.*" (H. Tuttle.)

Hence the human mind, enlightened by scientific training, no longer needs that mighty hand which, working from without, as men were once obliged to believe, rouses the incandescent spirits of the bowels

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of the earth to a sudden tumult, which pours the waters of the deluge over the globe and from time to time moulds the whole system to his purposes, as the sculptor does the plastic clay. If these objects, as theists would have us suppose, were really the gradual preparation of the surface of the globe for the living creatures that are to exist upon it, more particularly mankind, it is quite impossible to understand why divine Omnipotence, which must be regarded as the cause of all these changes, should have needed such efforts and such roundabout ways to attain its end, and why it should not, or could not, have done at once and without hesitation what appeared to be good or expedient for the realisation of these designs. It requires a stupendous amount of imagination for any one to deem it possible that the divine Omnipotence or supreme Intelligence can have found it necessary to use such vast periods of time and work such fearful catastrophes, involving in each instance the extermination of all living creatures in existence, to finally carry the earth and its inhabitants, through a cycle of transitions and improvements, to its last and highest goal, which is no other than that of forming a suitable dwelling-place for the most highly organised of animals, man. Can a power which we look upon as unlimited and absolutely perfect, knowing everything and foreseeing everything, be subject to such narrow limitations and require, as it were, such protracted training and rehearsals, before it can attain its object or accomplish its will? And what reason could such a power allege for the continually recurring destruction of a whole creation and world of living things, if not the need of constant self-

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improvement which is in diametrical opposition to its omnipotence, perfection and omniscience? This is so clear, so obvious even to the intelligence of a child, that a savage belonging to the Bechuanas, who inhabit the interior of South Africa, when Moffat the missionary was trying to make him understand the Christian idea of creation, replied with a sneer: "If you really think that only *one* being created all men, you must admit that this being gradually improved as it went on creating. At first it tried its hand at the Bushman, then at the Hottentot, then at the Bechuana, till in the end it succeeded in making the white man."

Hence there is no other explanation of the events connected with the story of the creation of the earth than that which lies in the natural facts themselves. Only the inevitable and endless difficulties which Nature had to overcome in the gradual formation of the crust of the earth and of its organic population, which difficulties could only be mastered in vast periods of time, can offer us a satisfactory solution of the problems with which the genesis of the organic as well as the inorganic worlds taxes our perspicacity. —

The actual length of the periods needed for the earth to attain its present condition can be fairly well estimated in consulting the computations geologists have made respecting single phases thereof, or respecting the length of time necessary for forming individual strata. Thus, for instance, according to Professor *Bischoff's* calculation, the formation of the carboniferous strata required a period of more than a million, and according to *Chevandier* from

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600,000 to 700,000 years. This figure, however, applies only to the formation of coal itself, so that it would be necessary to add the time required for the formation of the nearly 10,000 feet of "grit" (sandstone, conglomerate and shale). Professor *Philipps* (Life on the earth, 1860) computes that the oval-beds of South Wales, including the grit, took about 500,000 years to form. The time required for the development of the strata of the tertiary period, ranging from 3000 and 5000 feet in thickness, must have been at last 350,000 years, while, according to a calculation made by A. von *Humboldt*, the guano deposits, some of them nearly 100 feet thick, consisting of the excreta of sea-birds, must have taken nearly three times as long to form. The calculation of the English scientist *Croll*, quoted by *Grove*, make it certain that since the last glacial period (falling at the end of the tertiary or at the beginning of the post-tertiary period) no less than 100,000 years must have elapsed — "a space of time apparently not very long, if measured by geological eras, but probably very much longer." The same author estimates the duration of the so-called Eocene or Miocene, the first two subdivisions of the great tertiary period, at from one million to several millions of years prior to the year 1800 of our era! It is obvious that we encounter much higher numbers, when we come to consider the periods it must have taken to form the entire stratification of the earth's surface, such as we know it; these periods must count by many millions of years. *Lyell* considered that they represented a total of 560 million years. This figure may be, and probably is, excessive, and we shall be nearer the mark if we

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assume a period of a hundred million years to have elapsed from the time when the first living forms appeared on the earth and the oldest stratified rocks were deposited, down to the present day. According to *Helmholtz* this figure, or even a smaller one, is near enough for the entire age of the world as an individual planet, while on the other hand some scientists, such as Falb, Klein etc., bring the number up to 2000 million years. As regards the age of the solar heat, it appears from astronomical researches that our earth cannot have existed as an independent planet for more than a hundred million years, while on the other hand Prof. *Bischoff*, judging by experiments with a molten and slowly cooled disc of basalt, has come to the conclusion that the originally incandescent mass of the earth must have required at least 350 million years to cool from a temperature of 3600° down to 400°. *Blandet* and *Vinot*, two French scientists, have obtained yet higher figures, grounding their calculations on the physical theory of light. They estimate the age of the earth at the enormous number of about 6000 million years. If we take our stand on this number as a basis, we find that the age of Neptune, the oldest planet of our solar system, would come up to 42,000 million years! What endless periods of time must have elapsed since the original mist of our solar system had become sufficiently condensed for Neptune to separate itself from its equator in the form of a ring of vapor!

Now, whether one or another of these calculations be the more accurate, they shew in any case what endless periods of time our dwelling-place the earth required, in order that, after passing through

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innumerable and scarcely perceptible transitions, it should at length become what it is now; and this is to be accounted for only by the theory of a gradual and very slow development, and not by that of the personal intervention of an omnipotent entity. The numbers quoted above lead us to another inference, which is this: In connection with the immeasurable distances which the astronomers have discovered in the universe and from which our powers of imagination derive problems they are unable to cope with, the immensity of the periods alluded to brings home to us the necessity of recognising the illimitability of time and space, that is to say, eternity and infinity.

Should the conceptions of religion, which represent God as *eternal* and *infinite*, be preferable when carried to their logical ends, to the theories of science? Does the rabid fanaticism of priests, which invented the eternity of hell-fire, surpass scientific research in boldness of thought? "Whatever may be said of the end of the world, it is all as vague as the legend of the beginning, which the infantile mind of nations invented. The earth and the universe are eternal, since eternity is an essential property of matter. But matter is not unchangeable, and because it appears in varied forms man's limited intellect, while yet unillumined by scientific research, holds it to be finite and destructible." (Burmeister.)

"Aeonen kommen und Aeonen gehn,
Doch unbeachtet rollen sie vorüber;
Denn was sind selbst Aeonen, wenn gesehn,
Der unbegriff'nen Ewigkeit genüber?"

(Helionde.)

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(Ages come and ages go, rolling past unnoticed; for what are even ages in comparison to unconceived eternity?)

That which modern science, armed with the most magnificent appliances, teaches as an almost irrefragable fact, man had learned some thousands of years ago by logical thought, unsophisticated by the religious and philosophical prejudices of our enlightened age, and it seems inconceivable that such a simple and necessary thought as that of the *eternity of the universe*, can ever have faded away from the human mind. "Almost all the *ancient* philosophers are agreed in regarding the universe as eternal. *Ocellus Lukanus* says expressly, in speaking of the universe, that *it has always been and ever will be.* All unprejudiced persons will feel the force of the axiom that *out of nothing nothing comes.* Creation, in the acception in which the word is need by the moderns, is a theological subtlety." (Système de la nature, première partie, Note 7.) "None of the gods has formed the world, nor has any man; it has always been." (Empedocles, 450 B. C.)*)

*) Further information on the subject of this chapter may be found in the essay on "Creation" in the author's work "Natur und Geist"; also in the first of the "Vorlesungen über die Darwin'sche Theorie." That the Biblical or Mosaic account of the creation of the world in six days — which in depth and magnificence of conception ranges far below that of Manu, the Indian lawgiver, who lived long before Moses and from whom it is evident that part of the account contained in the Pentateuch is borrowed — can in no way be reconciled with the theories or results of science, is shewn in detail in the author's works "Licht und Leben," p. XXXIII, and "Der Gottesbegriff etc.," p. 27 and 28.

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ORIGINAL GENERATION.

It is certain that the appearance of animal bodies on the earth is the expression of such forces, and a function of these, resulting with mathematical certainty from the existing conditions.

Burmeister.

One thing may be unhesitatingly proclaimed by modern science, viz. that organized things are no more the results of separate creations than the so-called unorganised ones; that they are nothing more than special forms in which universal matter appears, and from which, like all the other individualized bodies, they have gradually evolved.

V. Graber.

It appears to me that every rational physiologist, provided he admits such a thing as the genesis of life, is compelled to trace it to a peculiar aggregation of chemical and physical forces.

Virchow.

It is not to be doubted that in the early history of our earth organisms must have been produced abiogenetically; the origin of living things must necessarity have sprung from inorganic matter.

W. Wundt.

There was a time when the earth as a fiery ball was not only incapable of producing living things, but actually hostile to the existence of any vegetable or animal organisms in close proximity to its surface. Not until after it had gradually cooled down and become solidified, and after the surrounding watery vapors

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had been precipitated on it, did the crust of the earth assume a form and condition which in its further development prepared the possibility of the origin and existence of manifold organised forms. With the formation of water, and as soon as the temperature permitted, organic life also evolved. At first it appeared but in the lowest and most imperfect forms, but in the long course of long periods and in keeping with the development of the earth itself, it unrolled itself gradually into the whole wealth of forms, shapes and individuals which now inhabit the surface of the globe, and which inhabited it throughout the almost endless duration of pre-historic ages. This we infer with absolute certainty from the fact already mentioned in the preceding chapter, that every stratum accessible to our investigation contains within itself the clear and partially well-preserved remnants, traces and relics of the vegetable and animal organisms which existed at the period of its deposition. For those ages of the deepest scientific ignorance are long gone by and will never return, in which these remains were looked upon as mere *lusus naturæ*, i. e. when it was thought that Nature had amused herself in representing the forms and features of living animals in stone, or when they were thought to be ruins left by the Mosaic deluge. The times are also gone by in which it was held almost universally that all the various kinds of lowlier animals or plants, down to the Infusoria, had arisen without parents from the mere interaction of the elements or by what was called spontaneous generation.*) The more progress

*) Aristotle thought that eels were generated in mud; Ovid assigned the same origin to frogs, and Pliny in his Natural History

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science achieved by the aid of the microscope, the narrower became the bounds within which the belief in spontaneous generation, once so widely spread, receded; until at last a halt was made at the simplest form-element, from which all aggregated organic beings originate without exception, viz. the *cell*. The English physician *Harvey*, the famous discoverer of the circulation of the blood (1619), laid down this important principle: *Omne vivum ex ovo* (all that lives is from an egg), and this principle was subsequently expanded into: *Omne vivum ex vivo* (all that lives is from the living); it being understood that the propagation not only takes place through the germ previously procreated by similar parents, but also more directly from existing parental bodies, by the processes of fission, buds shoots, free cell formation, etc.

This phrase means therefore that life, or anything living, can never originate spontaneously, nor from the mere aggregation of its elements, but only as the continuation of an already existent identical or similar life. In modern times, as the cell became recognised as the ultimate organised form-element, or as the organic unity, the theory of it was formulated more accurately by *Virchow* in the words: *Omnis cellula ab cellula;* that is to say, there is no organised cell which has not originated from a pre-

made all insects spring from the dust of caves. Even as late as the Middle Ages it was thought possible to produce snakes and mice in the laboratory; fishes, frogs, snakes and rats were believed to be generated spontaneously, and it was seriously contended that the black or mourning-duck originated in the rotten wood of old ships or from a mussel (Lepas anatifera). Even at this day, popular superstition still clings to the idea of a spontaneous generation of all kinds of vermin (fleas, bugs, etc.).

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viously existent cell of the same or of similar kind. But as it was found in the further course of these researches that the cell was a somewhat variable form, that it was not always the same, but sometimes shewed one kind of ingredients, sometimes another, a yet more exact distinction was drawn, and by directing attention to that part of the cell which seemed the most constant, the so-called nucleus, the phrase was again changed to: *Omnis nucleus e nucleo,* or each cell-nucleus originates from another nucleus. But whatever formula was given to the theory — or may be given to it in the future — the thought or principle lying at the root of it is that organised forms cannot originate spontaneously, and that one or more organised individuals or units must have been present in order that a new one should originate. The stories of the Old Testament expressed this truth, already known in its broad outlines, in an allegorical form, by making two of every kind of animal enter the ark to be saved from the universal deluge.

For those who are not contented with biblical stories, several questions must arise in the face of such facts, viz., where and how did the origin take place? What was the primal generation of organised things? If all organised beings have proceeded from previously existent organisations, from parent forms, how did the first parents arise? Did these arise spontaneously, merely by the fortuitous or necessary concourse of the elements under certain conditions, or were they called into existence by the voice of an external power, by a supernatural creative act? And if the first be the case, why does the same thing happen no more at this day?

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This weighty question has long occupied philosophers and scientists, and has given scope for the most varied and most extensive controversies. Before we enter upon a closer investigation of this question, we must first remark in regard to the axiom quoted heretofore: *Omne vivum ex vivo* (All that lives from the living), that whilst it is true so far as the vast majority of all organisms is concerned, it cannot under present conditions be accepted as holding good throughout. In spite of numerous and very carefully made experiments, in spite of the severest efforts made and discussions carried on among scientific men, the disputed question of *generatio æquivoca* (*generatio spontanea*, or *primaria*, or *heterogenea*, or *inæqualis*); known also as archibiosis, autogony, or abiogenesis, that is spontaneous generation, or heterogenesis as it is called in France, has not yet entered upon such a stage that it can be regarded as definitely decided. *Generatio æquivoca* signifies the generation of organised beings without the pre-existence of similar parents or parental germs, merely by the necessary or accidental aggregation of unorganised elements and physical forces, or from organised but dissimilar parents by the decomposition of their constituents. These two forms of generation have lately been distinguished, according to the nomenclature proposed by Professor *Haeckel*, of Jena, as *autogony* and *plasmogony*; by autogony is meant the coming into existence of the simplest organised individual in an inorganic fluid containing ammonia, carbonic acid, etc.; by plasmogony the coming into existence of such a being in an organic fluid, containing the constituent materials in the form of complex and free carbon-compounds. The

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numerous experiments on spontaneous generation made up to the present time have been almost entirely of the latter kind, that is to say, on plasmogeny.

Although, as we said before, the most recent researches have gone to shew that this kind of generation, despite the wide range that used to be given to it, has no scientific basis to rest on, it does not seem altogether ont of the question that it may hold good for the smallest and simplest organisms, the so-called microphyta and microzoa. Such well-known scientific investigators as Pouchet, Pennetier, Joly, Musset, and Onimus in France; Child and Bastian in England; Mantegazza in Italy; Wyman in America; Schaafhausen in Germany, and many others, have declared themselves in favor of this hypothesis, and rejected, in a certain measure at any rate, the theory of *panspermism* or of the universal presence of organised germs in the atmospheric air, as put forth by those who, like the French scientist *Pasteur*, are opposed to heterogenesis. They regard the building-up of formed organised bodies out of unformed organic substance as no more miraculous or striking than the formation of crystals from the so-called mother-lye, that is to say, from a fluid containing their constituent elements. Of course this relates only to the lowest and simplest beginnings of life in the form of the so-called monads, while the forms that are somewhat more highly organised develope from these stage by stage; just as in the course of geological periods the plant and animal world has developed or evolved step by step. "There is," says *Pennetier*, "a greater distance between a colpoda or a ciliated infusorium of the higher sort and a bacterium, than between an

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elephant and the lowest mammal." Very diverse forms may also be produced in infusions by changing the materials and the surrounding conditions; and by driving *the same air* into different solutions, the most varied fauna and flora can be evolved. Spontaneous generation is the original condition of life, while the transformation of species represents its continuance.

It stands to reason that even supposing everything to be true which is advanced by the advocates of spontaneous generation in the form of plasmogony, it does not follow by any means that there exists that organic material which forms the mother, or necessary precedent, of all the organic forms proceeding therefrom. This, in connection with the fact that most scientists have either rejected or doubted the theory of spontaneous generation in the alleged manner, and without the presence of a precedent germ, has afforded to the theological tendency in science a welcome pretext for appealing to the intervention and activity of a higher Power standing outside nature, which, it is contended, must, of its own free will and authority, have created those earliest and first beginnings of organised existence at a definite period of the earth's formation and must have implanted in them the capacity for their vast subsequent development. In point of fact, the supporters of the hypothesis of creation, as *F. A. Lange* cogently remarks in his "History of Materialism," love to shelter themselves in those dark corners which science has not yet illumined with its rays, and there to hang up their cobwebs to catch sound reason in. Nay, not even the most distinguished scientists and thinkers, such as a *Cotta* or a *Secchi,* have been able

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to keep their minds free from the influence of these ideas and from the bewildering pressure of this problem, so much so that, with respect to the genesis of organic beings, the former cannot help himself but must needs call in the "unfathomable power of a creator," and the latter feels contrained to appeal to "the conscious activity of an eternal architect."

Without troubling too much about a natural explanation of organic origin and growth, it may be replied to these believers that the germs or first beginnings of all living things existed from all eternity, awaiting only the concourse of definite external circumstances — either in that formless vapor from which the earth was gradually condensed, or else in space, from which they descended on the crust of the earth after it had formed and cooled down, and that they only became capable of further development wherever the necessary conditions were favorable to it. However startling such a theory may appear at the first blush, it must certainly be admitted that there is more intrinsic probability in it than in the hypothesis of creation, which rests on no scientific foundation whatever. Moreover, this bold theory, since it was first propounded by the author of this work in the year 1855 (see the first edition of *Kraft und Stoff*, pp. 74 and 75), has been corroborated by such a number of important facts, that the conception of the *cosmical* nature and the *cosmical* origin of life and of organised matter has by this time obtained a recognised standing among the current scientific hypotheses on the beginning of life, and this has been acknowledged by many scientists of mark. At any rate, there is no reason for rejecting as impossible the idea that

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organised matter or even complete organisms existed in the earliest ages in the higher regions of the terrestrial atmosphere, considering that great numbers of microscopic organisms have been found in the finely divided watery particles of the highest clouds of vapor that can be got at, and that *Angus Smith* has shewn by means of permanganate of potassium that atmospheric air, however pure, always contains a very small quantity of organised matter. *Ehrenberg* gives out as his deliberate opinion that organised beings actually exist in space, from whence they occasionally come down on our globe. Indeed, it happens frequently enough that the earth passes through meteoric clouds, tails of comets and similar bodies, and might, in its progress, gather up millions of organised beings or of their germs. According to *Quinet* (Die Schöpfung, Leipzig 1871, pp. 276, 277), life is of *cosmical* origin and *cosmical* nature and is as old and as widespread as matter itself. The earth, he thinks, attracted and still attracts the germs of future life to itself from the cosmic mass. *Meibauer* (in the second edition of his "Sonnen-System", Berlin 1872) has collected together all the facts which go to shew "that organised germs (of cosmical origin) are carried to us on the earth by the air spread throughout the solar system." The famous traveller and naturalist *Moriz Wagner* also accepts this theory in several excellent articles written by him in the *Allgemeine Zeitung*, and considers that life is as old as matter itself, or is imported into it from universal space. "The atmospheres of the celestial bodies," says Wagner, "like those of the revolving cosmical vapor-masses, must henceforth be regarded as permanent conservatories for

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the living forms and as the eternal green-houses of organised germs." Prof. *Semper* (Der Häckelismus in der Zoologie, 1876) speaks of the hypothesis according to which "the life on our globe is derived from organic germs belonging to other worlds, which fell upon it before the existence of any earthly life in one of earliest geological periods." The English scientist *Sir W. Thompson*, and the famous German physiologist *Helmholtz*, have declared in favor of this hypothesis; there is but one thing that militates against it, and that is the extraordinarily low temperature (– 238 to – 256° F.) of the cosmical space. This difficulty however, does not make any difference if we assume, as some scientists do, that the meteoric stones and meteorites which fall on the earth actually bring with them the cosmical life that exists beyond our earth. Chemists have in fact been fortunate enough to demonstrate the presence of organised substances, generally in a carbonised condition in a great number of meteorites*); and in connection with this it must not be forgotten that although meteorites may be incandescent on the surface in consequence of friction, it is quite possible that in their interior they may harbour organised substances without these being injured. This circumstance further proves the presence of organised substances in the spaces traversed by the meteorites; and since it has been suggested that the whole earth may have been formed by meteorites falling of a heap together or by particles attracted

*) Further details may be found in F. Mohr's "Geschichte der Erde," 2. ed. 1875, and "Ueber Natur und Entstehungs-Art der Meteoriten" in Liebig's „Annalen der Chemie", vol. 179; also in Klein's "Kosmologische Briefe" (1877) pp. 143—145.

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from space, there would hence be nothing strange in the idea that organised substances existed on earth from the very first. Nay assuming the meteorites, which fall every year in countless numbers on our earth, to be, as many learned men hold, broken fragments of other worlds, it is self-evident that organised germs or substances must necessarily be conveyed by them to the earth. Dr. *Otto Hahn* lately made out that he had discovered actual traces of plant and animal remains in meteoric stones, and various investigators, such as Dr. *Weinland*, Professor *Karsten* and others, have pronounced his discovery to be accurate. If this be so, we have before our eyes the actual remains of living creatures from another, possibly broken-up, celestial body. The commonest kind of meteoric stones consists of a mixture of iron and various rocks, and contains a number of small globular bodies, which have obtained for these stones the name of *chondrites*. These chondrites are sometimes quite black and contain amorphous carbon and bituminous substances, probably products of the decomposition of organic compounds. According to Dr. Hahn, they are nothing more than a mass or tissue of animals or plant-animals of the lowest kind, such as sponges, corals, crinoids, etc. According to Dr. *Weiland*, (Ausland, 1881, p. 302) they are remains of corals belonging to the family of the favositina, which on earth are found only as fossils in the very oldest strata; in the chondrites they are of liliputian size as compared with their terrestrial relatives. *C. Kapp* (Westermann's Monatshefte, August, 1881) regards this discovery as authentic and thinks that meteoric stones and meteoric iron are *only* of

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organic origin; indeed, that the earliest beginnings of all planets (including, of course, the earth) were organic formations!?

Some *savants* have lately gone so far in this direction as to completely reverse the view hitherto considered as true and to regard all inorganised nature as a product of vital activity, while others again maintain that both the organic and the inorganic kingdoms are products of differentiations, or evolution, proceeding from an originally indifferent condition of matter. Life, on this hypothesis, is only a peculiar mode of motion of the molecules of the primal matter in a state of condensation, and this theory would render any explanation of the origin of that primal matter unnecessary.

All this is as yet a mere hypothesis or conjecture and goes no more to solve the problem in an empirical or scientific sense than does the hypothesis of the cosmical origin of organised substances or germs. For if the latter hypothesis were shewn to be the explanation of the presence of life on the surface of the globe, it would yet not answer the question of the first origin of organised matter as such or of the first germ of life — unless indeed the theory be accepted, as explained above, that living matter has always existed or at any rate must be regarded as latent in the primal condition of matter. But since the idea of the eternity of an individual is illogical and all that is individual is transitory; and seeing that motion as such is eternal or without beginning, yet life as a special or definite mode of motion must have had a beginning, we are no nearer to a solution of the difficulty; we must assume or admit that the

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organised compound in the form of what is called protoplasm or the material of primal formation or life must have originated at some time in some place. And this offers in reality no logical nor empirical difficulty. On the contrary, spontaneous generation in this restricted and limited sense must be regarded as a logical postulate or as a necessary demand of human reason and science. It is the logical consequence of the appearance and gradual growth of organised beings on the surface of our own or of other planets, and an indispensable hypothesis by the side of the fundamental facts of astronomy and geology. It would imply a perfectly inadmissible interruption of, and break through, the universal causal relationship that obtains throughout the correlation of nature, if we admitted that there was a single moment in the history of the formation of the earth and the celestial bodies in which that unity was interrupted or destroyed by a supernatural intervention or creative act. Most probably living combinations of material particles, and similar combinations endowed with vitality, have at all times existed somewhere in the universe, and have developed further wherever certain external circumstances or conditions were realised. Long before the commencement of animal or vegetable life on the earth there may have existed combinations either living, or endowed with vitality, which developed further on that same earth, when its surface had reached a condition favorable to such development.

But those also who do not accept the hypothesis of the cosmical origin or the cosmical diffusion of organic matter, or who prefer not to take it into account, are forced to admit that somewhere and at

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some period in the history of the formation of the earth, there must have been a moment at which organic matter sprang from inorganic matter under conditions as yet unknown. That such a springing into existence may perhaps occur no longer at this day or — we had better say — has not yet been observed, proves nothing against the occurrence of spontaneous generation at an earlier period and under conditions differing essentially from those of the age we live in. It is obvious that the general conditions of life in the primordial or earliest periods of our planet must have been very different from those of the present and must have been favorable to the springing-up for spontaneous generation. We need only remember that at that time the atmosphere was replete with that most important of organic elements, *carbon*, which subsequently assumed the shape of coal-mines; we need but think of the difference in the density and the electrical conditions of the atmosphere, the peculiar chemical and physical state of the primeval ocean, and many other similar facts. "When our planet," says Professor *O. Schmidt* in his excellent little work, "Darwinismus und Descendenzlehre" (Leipzig, 1873), "had arrived at that stage of evolution at which the temperature of the surface permitted the formation of water and the existence of albuminous substances, the quantities and proportions of the component parts of the atmosphere were different from what they are now. A thousand circumstances which we are now unable to produce, may have led to the formations of protoplasm or of the primal organism from its constituent particles." Thus there is not the remotest scientific difficulty in imagining that the law

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of nature from which spontaneous generation must have resulted, is at present latent, or hidden, owing to the absence of the necessary conditions, whereas it was in full activity in the past, under conditions essentially different. This is also evidenced by the fact that a large number of widely diffused inorganic substances, such as precious stones, pit-coal, granite, quartz, etc., are apparently formed no longer at the present time, yet no one has any doubt that they originated in the past in perfectly natural fashion as the products of chemico-physical forces.

"Chemistry", says *Virchow* (Gesammelte Abhandlungen zur wissenschaftlichen Medicin, 1856, p. 25), "has not yet built up any of the formative substances (sarcode, albumin, starch) out of their elements, nor can as yet natural philosophy, outside the living organisation, force any of these given bodies to form cells. What does it matter? If the history of the earth shews us that there was a time when none of these substances existed nor could exist; if we see that, later on, certain periods arose in which these bodies were formed, and from them organised bodies, what can we conclude save that in the most unusual conditions the miracle happened, which means the momentary manifestation of the latent law?" And again in another place: "We can only suppose that, as I said on a previous occasion, at a certain period of the earth's evolution unusual conditions supervened, under which elements entering into new combinations, *in statu nascente*, assumed the vital movement, and thus the ordinary *mechanical* conditions were formed into *vital* ones." And finally: "The law by virtue of which the formation of organic generation or cells

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takes place, must necessarily be eternal, and at each period at which, in the course of natural processes, the conditions are favorable to its manifestation, organic formation results. The cause of this activity can only be sought in a peculiar arrangement of physical conditions, in an unusual interaction of ordinary materials occurring at specific periods; *and the process of life, both in its beginning and in its repetition, must be referred to a special kind of mechanics.*"

However, since the above was written, the whole question of abiogenesis has entered upon quite a new stage and one far more favorable to the theory of its occurrence at the present time, in consequence of the influence of the famous Darwinian theory, and the investigations of Prof. Haeckel of Jena on the monera, the simplest primal organisms out of which the first cellular organisms must have developed, which investigations open up new paths to Science. According to these investigations the cell or organic unit, which had previously been taken as the starting point of spontaneous generation, and which was regarded as such even by a Virchow, appears in its complete formation of integument, substance, contents and nucleus, as a formation that is much too complicated and too highly organised to be regarded as the subject of autogony, that is to say as arising immediately from inorganic matter. Such a springing into existence appears as much as a miracle, or an impossibility, from a scientific point of view, as the spontaneous growth of a more highly organised creature from dead matter, which was at one time so widely believed in. On the contrary, the cell is itself apparently a product of a whole cycle of preceding

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processes of development, and the beginning of life is not to be sought for in it, but much further backwards among yet lower forms of life, lately discovered, which exist not as cells nor as cell-like forms, but as mere lumps, as wholly unformed slime, or an aggregation of albumenoid jelly. These simplest primal organisms, which are nothing more than simple living protoplasmic masses without any differentiation, "organisms without organs," and which stand just on the boundary between organic and inorganic bodies, have been named by Haeckel *monera* (from μονήρης, simple); and organisms more simple or more imperfect than these cannot, he thinks, be imagined. It is these only which have arisen and still arise from spontaneous generation, by autogony or self-formation from compounds of organic materials; and from these only can be evolved cells or cellular formations. "They prove irrefragably that life is united not to a special anatomical arrangement of the living body; not to the co-operation of various organs; but to a certain physico-chemical constitution of formless material, to the albuminoid substance which we call sarcode or protoplasm, a nitrogenous carbon-compound in a semi-fluid state. Life is therefore not the result of organisation, but the reverse. The formless protoplasm makes the organised forms .... *The oldest organisms, which arose by spontaneous generation from inorganic matter, must have been monera.*" (Haeckel, Das Protistenreich, 1878, p. 84.)

The conception of *generatio æquivoca*, or spontaneous generation, appeared only so difficult, Haeckel thinks, while those simplest organisms, the monera, were still unknown; but now there can be no doubt

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that they represent the earliest stage of life, and that from them were developed cells or cellular organisms, in a manner upon which we cannot discourse here at greater length. The real or true cells arose by *internal*, the pseudo-cells or cell-like anucleated cytods by *external* evolution of the monera. The first stage of this evolution is represented by the most undifferentiated cell-form, which in the shape of amœba or Proteus animalcula still leads an independent solitary existence at this day. Such an undifferentiated cell of the simplest amœboid form is the original egg, as it appears throughout almost in a uniform configuration in the ovary of the most widely-separated animals. The most ancient amœbæ lived as hermits; from them were formed little amœba communities, such as may yet be found as groups of simple homogeneous, naked communities of cells or aggregations of monads, living together. Here we find the earliest demarcation between the vegetable and animal kingdoms; for the naked but nucleated amœboid cells, capable of movement, partake rather of the latter, while those which are furnished with an enclosing membrane, which imbibes fluid nourishment through its pores, rather belong to the former.

As regards the first or earliest appearence of the monera, it must, according to Haeckel, have taken place at the bottom of the primal ocean which enveloped the earth as it first cooled down. "Many generations of monera may for thousands of years have peopled the primal ocean which covered our cooled-down globe, ere the change of the external conditions of life which were suitable to these homogeneous original forms, brought about also a change in their own

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homogenous albuminous bodies." The greater number of the species of Monera which so arose may have again perished in the struggle for existence, while others survived and became the ancestors of the whole organised world.

Haeckel does not answer the question, whether this process of autogony or of the spontaneous generation of albuminous and living material from lifeless matter, which must certainly have taken place formerly, still continues at the present day. But the question may in all probability be decided in the affirmative, although this spontaneous generation takes place under circumstances and conditions with which we are as yet not fully acquainted, and which, if we knew them, we should possibly not be able to produce artificially. However, it does not follow by any means that this must hold good for ever and at all times. When we think of the magnificent results of *synthetical* chemistry, which has succeeded in building up by chemical means, out of none but inorganic substances, a whole mass of materials and bodies which were thought to be producible only by the vital activity of plants and animals, such as: urea, alcohol, ether, grape-sugar, racemic acid, ocalic acid, formic acid, butyric acid, acetic acid, lactic acid, fat, amyloids, alkaloids, etc. — that man need be no visionary who holds that chemistry may at some future day succeed in artificially producing living protoplasm; and we may readily agree with *W. Wundt* (Lehrbuch der Physiologie, p. 169), when he says that our present chemical synthesis "is perhaps only the first step towards such a consummation."

When once we are in a position to make living

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protoplasm, we shall also be able to originate artificially or voluntarily those lowliest forms of life, about which there is at present so much controversy going on between the opponents and supporters of heterogony or spontaneous generation, a controversy which is carried on with such extreme bitterness, althought, to our thinking, it is not at all likely for science to derive any benefit from it. Nature presents but a single chain of cognate phenomena, unbroken by any insuperable gaps. By her own power — whether in one fashion or in another — she brought forth the first materials and forms of life; by her own power she caused these to develope further and further; by her own power she well destroy again her own creations, and resuscitate them in other places, and in new forms and shapes!*)

*) Compare the details on spontaneous generation in the author's: "Die Darwin'sche Theorie," pp. 110—135 of the 4th edition; in "Aus Natur und Wissenschaft," p. 430 et seq. of the 3rd edition; in "Natur und Geist," p. 230 et seq. of the 3rd edition; and in "Physiologische Bilder," vol. I, Essay on the Cell.

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SECULAR GENERATION.

"Evolution" is henceforth the magic word by which we shall unravel, or at least get into the way of unravelling, all the enigmas that surround us.

Haeckel.

The hypothesis of creation, as postulated by certain dogmatic principles in a pretended connexion with religious, *i. e.* ethical views, cannot for a moment be entertained by natural science. The ever-recurring attempt at effecting a compromise between revelation and knowledge is a useless playing with ideas.

O. Taschenberg.

We shall recognise that by this rule all that is fixed is only apparent; growth, in the form of evolution, alone is true and lasting.

von Baer.

If thou will comprehend and hold fast these things, then will it be clear to thee that Nature, set free and relieved from her haughty lords, does all things by intuition and without the interference of the gods.

Poems of Lukretius Carus.
(99—52 B. C.)

Abiogenesis is succeeded by biogenesis, or that long succession of organised forms and species, which, when the first beginnings of life were once given, was to populate the surface of the world by gradual devolopment in the course of millions of years. This proceeded in strict conformity with the modified external vital conditions of the earth's surface becoming

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gradually more favorable; and the more removed and diverging these conditions are from those in existence at the present day, the more removed and diverging do these forms or beings appear also from those which now surround us, and which must be regarded as the latest and highest outcome of a long process of evolution and improvement. For the more ancient the fragments, traces or outlines of this earlier organic world found in the individual strata, or portions of strata, of the earth, the lower and the less complex are in general the forms or formations corresponding to these, and *vice versâ*. At the same time we come across the very significant fact that the periods of development of these lowest organisms must have been in comparison by far the longest, and that these periods decrease in length in proportion as the newly arising forms of life ascend in the scale of evolution. Thus the *archezoic or primordial period*, during which none but the lowliest water-plants and water-animals could exist at the bottom of what used to be the hot or tepid original ocean which covered the whole earth, was probably longer than the united four geological periods which succeeded it. Many million years had to pass away prior to the evolution of the protista, mollusca, vermes, of some crustacea and of the lowest cryptogams, such as algæ; millions of years again went by before the great age of fishes and fern forests set in. During the vast period of this primordial age it is probable that only aquatic plants and animals existed; certain it is that in all the rock-formations of this age there has not been found a single fossil which can be referred with accuracy to a terrestrial organism. Only at the very fag-end of

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this long period, in the *Upper Silurian* formation, do we find the first definite representatives of the vertebrate type, or the lowest organised descriptions of *fish,* preceded by the lowest vertebrates, which *Haeckel* designates as the "acrania." The ocean of the Silurian age, which left a deposit of no less than 20,000 feet in thickness, swarmed with invertebrate animals of all kinds, such as rhizopoda, brachiopoda, cephalopoda, radiata, polyps, articulata, graptolites, corals, mollusca, crustacea etc.; among the last the remarkable trilobites, tripartite crab-like animals, played the principal part. They lived through this whole transitional period in great numbers and varieties of form, in a thousand different species, but died out completely during the later carboniferous age. At the same time, the habitat of the Silurian animals was the same over the whole surface of the globe.

The age of the fishes and fern-forests, which is termed chronologically the *palæozoic* or *primary age* and which itself is composed of three great subdivisions, deposited strata 42,000 feet in thickness, and occupied a period computed at a third of the whole strata-forming ages. The two highest classes of animals, birds and mammals, are completely wanting during this period; on the other hand, as the distinction between land and water which in the sequel became gradually more strongly marked, began to show itself, there appeared the first terrestrial plants and animals, which only succeeded in gaining a permanent footing after an obstinate and long-continued struggle with the changing physical conditions surrounding them. But during this whole long period aquatic life was so much the more prevalent that

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the whole of this age, as stated above, has been styled the age of fishes. Fishes existed in many forms and kinds, although they had not yet attained their most highly developed type, which is that of the *osseous* fishes. Side by side with these, the vegetable kingdom attained during the middle subdivision of the primary period, the *carboniferous* age, that luxuriant development, the useful results and remains of which we are fully enjoying at the present day. In this primal vegetation, especially in its earlier stages, it is hardly necessary to remark that we have before us plants of the most primitive and original character. They are flowerless and seedless, the ancestors of our present equisetaceæ and silices. But whereas these latter are but the dwarfed remnants of their mighty precursors, crowded out by better developed rivals, and no longer able to attain any remarkable size and development, their great ancestors grew till they formed vast impenetrable tropical marshy forests, many expanding into gigantic trees, whose dead bodies, during the long carboniferous period, built up, layer upon layer, the coal-seams which we work at the present day. A dreary monotony was the characteristic of those primeval forests of the pre-historic ages, in which there was no trace of the variety and the floral beauty of the modern vegetable kingdom, and in which no butterfly flitted from flower to flower, no bee flew about, humming in its search for honey, and no bird hopped gaily from twig to twig. Scantily leaved calamites, or the pillar-like and almost branchless trunks of sigillaria or lepidodendra, with their furcated crown of bristly leaves, held supreme sway — while pale green ferns or cab-

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bage-like scaly haulms occupied the place of the underwood, the grass and the flowers. Foliage trees were utterly wanting at this period. In these hot, moist forests, contrasting by their extent and luxuriance with those that existed at the beginning of the preceding period, there appeared new formations of animal life, emancipated from the supremacy of water, air-breathing articulata and vertebrata, the latter in the form of creeping amphibia, prone on the ground, and able to live equally well in water or on land. The variety of their forms increases largely in the following Permian period, while the plants of the carboniferous age are being gradually supplanted by the more highly developed gymnosperms. Towards the close of this epoch we meet for the first time with lizard-like animals, being the earliest representatives of the *reptilia*, the lowest order of the higher vertebrata; these were to rule the third, or, leaving out the primordial age, the second great subdivision of the earth's history, that is to say, the secondary or mesozoic periods. But even in that age, the amphibious animals still hold a very subordinate place, as regards number and variety, in comparison to the colossal abundance of fishes, which, especially in the form of the *ganoidian* or enamel-scaled fishes, characterise several strata of the limestone formation, as for instance the *Kupferschiefer* (the marl-slate of the Permian.) Numerous embryonic or mixed types, which were subsequently to give rise to new forms by division and migration, impress on the palæozoic age the stamp of the highest degree of imperfection. Within the most diverse types, classes, orders and families we always meet

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first with the more imperfect design; sometimes they rise swiftly to the highest possible development, and subsequently disappear, to make room for other forms, belonging to a family of a higher grade. In the course of this development there are undoubtedly to be noticed criteria of an apparently lawless rising and falling-off of individual forms; yet we cannot but perceive therein, on the whole, an unmistakable progress from the simpler to the more complex, and from the lower to the higher formations.

The same remark holds good in regard to the subsequent *secondary* period or the *mesozoic* age, which follows now, and which, from the prevalence of the so-called creeping animals and of the higher development of the vegetation, has been termed the *age of reptiles and of conifers.* It consists of the three great subdivisions of the triassic, jurassic and cretaceous formations and embraces about the tenth or eleventh part of the organic history of our globe. The enormous development of the vegetable kingdom during the preceding periods had relieved the terrestrial atmosphere of the surplus of carbonic acid, a gas deleterious to the higher air-breathing animals, which was theretofore present in it, and had caused the greater part of it to subside beneath the ground in the form of coal. Thenceforward, the existence of higher animal life on the earth became possible, and it rose stage by stage, while the older forms receded more and more into the background or disappeared altogether. Among those that disappeared at the beginning of this epoch are the remarkable *trilobites* or tripartite crustaceans of the primordial ocean, as well as the strange, brilliantly mailed fishes of the silurian

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age. The huge display of the kingdom of creeping things, the reptilia, imparted a peculiar idiosyncracy to this middle period, as mentioned heretofore. During this period the whole of the subdivisions of the animal kingdom also underwent a rich and multifarious development, which was connected with an increasing elevation and extension of dry land and a greater diversification of the conditions of life, especially in consequence of the vivifying changes of clouds and winds, and of light and heat, which had now set in. Side by side with the palæozoic cryptogams or flowerless plants, was now evolved a rich flora of conifers, cycads and palms, and eventually of foliage trees. The waters swarmed with varied forms of the simplest animals, as well as beautiful radiates, corals and sea-urchins. The *cephalopoda*, those greedy pirates of the molluscan kingdom, which had existed in thousands of species during the silurian age, now reached their highest development. Mussels and snails shewed a marked increase, and the *crustacea*, or lobster-class, represented in the preceding age almost by the trilobites alone, now appear in whole classes and species. "Butterflies and *libellulæ* are seen, like dream-shapes pointing to a close blossoming future." (Dodel.) But most of the new and interesting forms are evolved in the *vertebrate* phylum. Among the fishes appear for the first time the *teleostei* or *osseous fishes*, destined to almost completely supersede their more imperfect predecessors with cartilaginous skeletons. In overpowering variety and multiplicity of species are seen the amphibia and reptilia, towering in strange and sometimes colossal shapes, and besides these we encounter avian and mammalian forms

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in their earliest beginnings, marchin glike heralds of an approaching future.

"The mesozoic world," says *Zittel* (Aus der Urzeit, 1872), "surpasses the preceding ages not only in its variety, but also by a higher degree of perfection, both collectively and in its individual parts. In the vegetable kingdom, cycads and palms and further on most highly developed type of dicotyledonous foliage-trees, and in the animal kingdom the three highest classes of vertebrates, viz. reptiles, birds and mammals, make their appearance as entirely or almost entirely new elements among those that previously existed, and this fact imparts a character of greater distinction to the whole array. But even within the individual classes and orders, forms of more perfect organisation have almost everywhere crowded out the earlier and undeveloped ones."

"Finally, the gradual springing into blossom of ceratites and ammonites may be accepted as a proof of the fact that throughout nature there exists a tendency to gradually fill up all places in her economy with an ever more perfect *personnel.* No less characteristic is the number of the so-called collective forms" etc. etc.

Yet another step forward, and we come to the *tertiary* or cainozoic age (from καινός, new), which, it is true, barely embraces the *third* part of the organic history of the earth, but which must be reckoned as having lasted many hundreds of thousands of years. In this period the present aspect of things begins to prevail more and more, and in progression, too, that proceeds at such a regular rate, that *Lyell* thought proper to arrange it in three subdivisions, in ac-

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cordance with the greater or lesser relationship of their fossil testacean shells to those of the present time. These subdivisions are: the *eocene*, or dawn of recent, with 3½ per cent of shells of living species of testacea; the *miocene*, or less recent, with about 17 per cent; and the *pliocene*, or more recent, with from 35 to 40 per cent of the same. This division has in the course of time obtained general acceptance. As far as the vegetation of this period is concerned, it is characterised by palms and foliage-trees, while in the animal kingdom the highest class, the *mammalia*, predominate, so that this epoch has been styled the age of *mammals* and *foliage-trees*. This change did not occur without concomitant changes in the surface of the earth itself, which, gradually losing its former general character, became more and more specialised. The vast oceans of yore were split up into smaller independent basins; each great continent developed its individual characteristics of landscape and climate, of geographical and biological peculiarities. The vegetable and animal kingdoms assumed more and more the character of those now existing with their infinite variety. "For the first time a brilliant world of flowers unfolded to the sunshine, and the modest plants of an earlier age which flourished unperceived, yielded the mastery to their coquettish rivals, gorgeous in color and in fragrance." (Dodel.) Among animals the lowliest, up to the fishes, already possessed their present form in all its essentials. But while the monstrous transitional types of the amphibian and reptilian worlds disappeared, which had characterised the former period, similar transitional mammalian types appeared in great variety; there

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arose the oldest fore-runners of our present hoofed animals, ruminants, and pachyderms, in some places in such vast numbers as cannot now be found anywhere on the earth's surface, the warm luxuriant climate of the earlier tertiary period yielding them a sufficient vegetable growth for food. The later tertiary period is characterised by the gradual drying-up and absorption of the great molasse ocean, and the permanent elevation of the Alpine ranges, with all the effects wrought by these great events on the geographical and climatic conditions of the continents, and in it the average temperature of the earth was raised 16° F. and the distribution and regulation of the zones of the earth became more like what they are at present. During this period both the invertebrata, and the fishes and birds attained in all essentials their existing development, while the variety of the fauna of the higher vertebrate animals surpassed everything that can be seen at this day in the most luxuriant scenery of the tropics. Then appeared those colossal proboscides (mastodons, dinotheria etc.), whose descendants are represented among us by our elephants and walruses; then arose also hyænas and viverras and the terrible *machairodus*, belonging to the feline tribe, with its dagger-like side-teeth, 5 inches long, the precursor of those carnivorous beasts of prey, whose meridian period is found in the succeeding diluvial age. Neither are numerous representatives of the remarkable race of apes wanting in this period.

In the following and last great division of the earth's history, the so-called *quaternary* or *cultural age* (the post-tertiary of Lyell), which is divided

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into the two sections of the *dilivium* or drift, and the *alluvium* or new deposit, we stand almost, if not quite, on the threshold of the present time. Although this period seems very brief in comparison with its predecessors, and, according to Haeckel, represents only one half per cent of the organic history of the earth, yet with its two great *glacial periods*, intervening between the tertiary and quaternary ages, it embraces *at least* a lapse of 100,000 years, and probably far more. All the changes which took place in living things during this time, expended themselves exclusively on the highest animal forms; the lines of demarcation of the present geographical provinces of fauna, which placed a limit to the further spread of individual species, were then already in existence. In the quaternary age, as the last and highest stage of terrestrial evolution, appears on the scene of existence the highest form of life, our own race, *Man*, in some measure the summit and crown of the graduated development, although his half-brute precursors, his preparatory forms, had already existed in more or less protracted succession during the tertiary period. On account of the vast importance of this event, which was henceforth to exercise an all-embracing influence on the whole future of the earth and on its vegetable and animal inhabitants, the quaternary period has been named the *anthropological* or more correctly the *anthropozoic* age. At any rate, the discoveries of modern investigation compel us to reckon the *antiquity of man on the earth* at a long succession of thousands, perhaps of hundreds of thousands of years and not, as was formerly done, at a very much shorter lapse of time, scarcely exceeding

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the historic period. The latest researches, as well as general considerations, make it appear in the highest degree probable that the much controverted existence of the so-called *tertiary man* is neither a myth nor a fable; that is to say, the earliest existence of man on the earth goes back into the last or perhaps even into the middle subdivision of the age preceding the quaternary, the great tertiary period. According to the famous American palæontologist, Professor *O. E. Marsh* (Paper read before the American Scientific Association, August 28, 1879), it is not excessive to set down the origin of man's existence as far back as the last glacial period of Europe, that is to say, at 250,000 years. But, in the opinion of the author quoted, it appears to be proved by Professor *Whitney's* famous discovery, in the American pliocene, of undoubtedly human remains and utensils made by human hands, that the tertiary man must have existed even prior to the time mentioned.

Be this, however, as it may, considering the enormous period taken up by the evolution of the earth, which period must be set down at many millions of years, man must always be regarded as one of the latest and most recent results of the great organic process of terrestrial formation and evolution, which finds in him in some measure its highest and thus far its final expression.*)

*) The important question of the antiquity of man on the earth is thoroughly treated in the excellent work of the famous English geologist *Lyell* "On the antiquity of Man." A more condensed exposition of the matter may be found in the author's "Man and his place in Nature," part I; also in the note on p. 160 *et seq.* of his work "Aus Natur und Wissenschaft" (3rd ed. Leipzig, Thomas, 1874).

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This progress of the organic history of the earth, of which we have given here but quite a general outline, proves, in our opinion, clearly and without the shadow of a doubt, that a perfecting and evolving principle, due partly to internal, partly to external physical conditions, is universally active, spurring on the individual forms to an ever higher development by countless intermediate steps and through protracted spaces of time, or causing continual changes in them. Of course, if all these intermediate steps, and the countless transitions which connect all individual forms with one another, be left out of the reckoning, and if the moneron or the primal slime be set side by side with a highly developed form, such as man, it becomes impossible to understand how the one could spring from the other, without taking into account the millions upon millions of intermediate forms. Even within a very limited circle of forms this appears often impossible; *a fortiori* it cannot be possible in the great whole. Thus the *sao hirsuta*, a trilobite from the Bohemian beds, which has already been ranged in twelve different genera and seven-and-twenty different species, is so unlike the later developments proceeding from it, that it would not be regarded as the same animal, were it not that the transitional forms can be distinctly shown. Similar examples of palæontological series of development might be cited in large numbers.*)

It stands to reason that it must not be supposed, as was done by the old school of natural history,

*) Compare the author's work on "Die Darwin'sche Theorie," pp. 142 *et seq.*, and pp. 275 *et seq.* of the 4th edition.

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that the organic stages of evolution can be represented as an unbroken chain, on which the links follow one another in direct succession; or, in other words, that we are to begin with the monera or the sponge, and thence proceed through all geological periods, following a strict sequence in time, until we reach the most highly organised forms, eventuating in man. This idea is so completely at war with facts that it was necessarily abandoned so soon as facts became better known. The consequence was that the whole theory of evolution fell for a time into disrepute. The organic graduation is not a simple one; it is complex and full of ramifications, which are often difficult to trace. The great organic kingdoms consist of a number of independent divisions or groups (e. g. radiate or star-like animals, mollusca, articulata, vertebrata) of which it is impossible to say that they are strictly graduated and levelled up on the top of each other. On the contrary, each division, after branching out from the main trunk or common stem, developed without connexion with the collateral branches to such a height as its nature or structure admitted of, very much like the branches and twigs of a tree, each of which develops independently of its neighbours, until it reaches a certain size or height, and then either dies off, or remains, or is overtaken by other branches that are growing up. Thus, an individual group, although springing from a much lower point in the main trunk, may, in its highest developments, overtake and get ahead of the one that originated further up, without in the least interfering with the general growth and development of the tree as such, or infringing the law of progress as a whole.

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And thus, the development of the vegetable kingdom, being the less perfect, did not necessarily, as was formerly believed, precede the development of the animal kingdom, being the more perfect of the two; but both kingdoms have evolved simultaneously and side by side with one another, from the primal stock of those lowest existences, the protista, which stand midway between the two kingdoms. However, the lowest strata have always contained the representatives of the typical forms of the higher and later developments in none but their earliest beginnings, thus on the one hand proving clearly that there are successive stages of evolution, and on the other showing that the theory of a single line of evolution and of the transformation of one great class into another cannot possibly be sustained. Each individual example has the tendency, as we have said, not to change into the next higher form, but to further develope and perfect itself after its own type. Thus, the cephalopoda, being a sub-division of the mollusca, are perfect animals of their type, and as such stand far above many groups of fishes, albeit the latter stand much higher as a class in the general scale of animal existence. The same holds good of the articulata which, although, as a class, they rank far below the vertebrata, yet in their highest developments, the bees and ants, rise to a point in many respects closely approaching man himself.*) The Vertebrate type, although bearing within itself the highest conditions for organisation, and therefore

*) Compare the Author's "Mind in Animals" (Freethought Publishing Cy, London).

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leaving all other classes far behind it in its ultimate development, actually begins with forms which, in themselves, stand much below the representatives of those same classes. If Professor Haeckel is right, this type begins with beings of such a very low organisation that they were not even looked upon as fishes by their original discoverers, but were thought to be worms or snails. It is also in evidence that these remarkable animals closely connect the great subdivision of vertebrata with the invertebrata or mollusca. Yet, despite this lowly origin, the vertebrate phylum in its higher developments has so surpassed all other phyla, that a direct comparison of its highest representatives with one another is scarcely possible. The great law of the progress and evolution of organised Nature shews itself all the more clearly by the fact of this group having attained such a high development. In a great many instances we are able, without much difficulty, to trace back the more modern to the more ancient forms, or to shew how the fossil representatives of later classes unite in themselves the general characteristics of subsequently appearing and, to some extent, of still existing forms, and thus become after a fashion the progenitors of the subsequent generations. The possibility of this proof increases year by year in proportion as the rapidly advancing palæontological investigation of our times enlarges the extent of its interesting discoveries. Thus the teleostei or osseous fishes of the secondary period and of the present time, have developed from the embryonal cartilaginous and enamel fishes (placoids and ganoids), which are the representative species of the preceding period, and occupy the low-

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est stage of the piscal type. The transition from these to the higher group of toads, the amphibia, is found in the *archegosaurus* (from ἀρχηγός, ancestor, σαῦρος, lizard) of the palæozoic period, which stands midway between fishes and amphibians. In the formation of its body it combines characteristics which we now meet but separately among fishes, frogs, salamanders, lizards and crocodiles, and which make it clear that this animal was the ancestor, evolved from the fish-type, of the *saurians*, those voracious monsters, which dominated the earth in the secondary period. The ancient *labyrinthodons* or fish-lizards, of which the archegosaurus must be set down as one of the earliest representatives, are, in *Burmeister's* opinion, the true and most beautiful prototypes of the amphibian conception in its totality, a conception worked out in many different forms through an evolution of millions of years. They combine the characteristics of the most heterogenous groups which subsequently evolved from them, and among them we find the peculiarities of saurians, turtles, frogs and fishes. In the *plesiosaurus* or the snake-lizard we perceive, as it were, the first attempt of Nature to emerge from the fish and reptile period. It has the body of a whale, the neck of a bird, and the head of an alligator, and on this account this animal which sometimes reaches up to eleven feet of length, has very appropriately been compared to a snake drawn out through a turtle. From that time forward it has been modified and repeated in countless species. "It is strange" says Zittel, "to remark how the characteristics of the most widely divergent aquatic animals appear combined in the Plesiosaurus just as though

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Nature had wished to produce in it the prototype of a swimming vertebrate of higher organisation. We must now seek for its cranial characteristics in two perfectly distinct orders; its long neck having been inherited by aquatic birds, and its fins by marine mammals, while its sternum has been developed in a special manner by the turtles." Its contemporary, the mighty *ichthyosaurus*, or fish-lizard, which has from 20 to 25 feet in length, is, as its name implies, a creature midway between fish and lizard, and likewise a fine specimen of an ante-deluvian collective type, or a reptile in the form of a fish. Its body resembles that of the dolphin, its head that of the crocodile, and its tail that of the fish. The *proterosaurus*, a true reptile from the marl-slate, is, according to *K. Vogt*, the first five-toed animal of the higher vertebrate type. The *mosasaurus* found in the later chalk (Maestricht) with its cranium from 3 to 4 feet long, with its snake-like body extending from 50 to 70 feet and containing more than 100 vertebræ, with its short webbed fore-feet, seems most closely allied to the fabulous sea-serpent, in which some still believe at the present day. The *megalosaurus*, a monster of colossal proportions, combines within itself the anatomical peculiarities of reptiles and of mammals, and the order of the so-called *dinosaurians*, to which its belongs, combines in a most remarkable manner the characteristics of lizards, crocodiles, mammals and even birds. A step higher towards mammals is seen in the *iguanodon*, a gigantic lizard with massive body, 30 feet in length and from 12 to 15 feet in height, "with which the creative force of Nature appears as if it would close the gigantic race of amphibians." (Buch der Geologie.)

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The *pterosaurians* or winged lizards (not to be confounded with the pterodactyl, the "winged lizard" of Lyell), are an offshoot of the lizards which approaches the avian type, while in the *ornithoskelidæ*, or reptiles with legs of birds, the peculiar characteristics of birds are to be found. One of these ornithoskelidæ is the *aëtosaurus*, recently described by Prof. *O. Fraas* from the Stuttgard Keuper, or the mailed bird-lizard of Stuttgard, which is so perfect a median type between a creeping and flying animal that it has received the name of the "eagle-lizard." By means of these and of other discoveries, both of reptiles with avian characteristics and of birds with reptilian characteristics, the apparently wide gulf between two classes which are as widely separated as those of *birds* and *reptiles*, has been narrowed to such an extent that there is now no difficulty in tracing both to the same origin, and in setting the bird down as a reptile adapted to an aërial life. The transformation itself probably dates from the jurassic age. During the same period originated the *pterodactyl*, which is also adapted for flying, an enigmatic aëriously-shaped animal, half bat and reptile, half amphibian and bird, which has been referred to all classes in turn. In the *cetiosaurus* are combined the characteristics of the whale, the phoca, and the crocodile. In the tertiary period, during which the present condition of things came more and more into view, the vertebrate animals already assumed the mammalian trunk and appendages, while still preserving to some extent the reptilian form. As the first representative of the higher classes of Mammalia, appears the *palæotherium* (from παλαιός old, and θηρίον, animal), an interesting

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animal, of which many specimens are extant, ranging from the size of a hare to that of a horse, and shewing characteristics of the horse, tapir, pig and rhinoceros; these specimens, being different varieties of the same genus, must have existed in very large numbers at the beginning of the tertiary period in South-Western Germany, especially on the Schwäbische Alp, in Würtemberg. This may be regarded to some extent as a prototype of mammalian classes, for the conceptions or tendencies of the most various mammalian forms are dormant therein. From this animal the *horse* of the present day was evolved through a series of the most varied intermediate forms (the *orohippus* of the eocene, the *mesohippus* of the lower, and the *miohippus* or *anchitherium* of the upper miocene, the *hipparion* or *protohippus* of the lower, and the *pliohippus* of the upper pliocene). Not less interesting for the palæontologist or student of the pre-historic world, are the near relatives of the palæotherium, the *anoplotheria*, which also originated in the earliest tertiary age, and, being possessed of the characteristics of the pachydermata, the ruminantia and the swine, must be regarded as the ancestral form of our present swine, hippopotami and ruminants. The *tillotherium*, which has quite recently been discovered by Professor Marsh in the mountains of the far West of North-America, was an animal which combined within itself, in a truly surprising manner, the most opposite peculiarities of the most widely divergent mammals, such as beasts of prey, rodents, hoofed animals, etc. The most probable ancestor of the tapir-group has been discovered by the American palæontologist *Leidy* in the basin of the Plate River,

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and received of him the name of *hyrachus*. In point of fact, the researches of American palæontologists, such as Marsh, Leidy, Cope, etc., in the wide plains of the Mississippi, have brought to light countless remains of fossil mammalia, chiefly of hitherto unknown species, which furnish as many proofs of the theory of evolution. — In the later tertiary period, the same as in the subsequent *diluvial* age, we find gigantic mastodons and dinotheria as fore-runners of our present elephants, the terrible machairodus as fore-runner of our present feline species, the cave-bear as ancestor of our present brown bear, the *bos primigenius* as ancestor of our neat cattle, and so on.*)

These examples might be multiplied to any extent, but all palæontological knowledge is, as it were, but one example. The lowest forms of each group first appear, and from them arises the ascending succession of the higher, in species as in individuals. "The remains found in the crust of the earth," says Oersted, "reveal to us a series of ever more highly

*) Even down to the present time some such early transitional or intermediate forms have existed as "living fossils." The remarkable Australian *ornithorhynchus* is an intermediate form between quadrupeds, birds and amphibians. When it was first brought to Europe it was believed to be an imposition; it was an old moleskin, people said, attached to the mandible of a duck. The *lepidosiren* of South America and Africa, being a connecting link between amphibia and pisces, breathes half by gills, half by lungs. The gill-bearing *Axolotl (Siredon mexicanus)*, if reared on land, loses its gills and turns from an aquatic into a terrestrial animal, breathing by lungs, and standing in the same relation to its previous form as a developed animal does to its larval shape. Further examples of palæontological transitional forms may be found in the author's already cited work on the Darwinian Theory, in the second lecture.

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developed formations, succeeding one another, until at last the conditions were reached in which man, and a vegetable and animal kingdom suitable for man, could prosper." "My belief in the law of progress," says even more emphatically the famous English naturalist Prof. *R. Owen*, at the conclusion of an excellent description of ancient mammalia of the mesozoic period, "from the general to the special, from the lower to the higher, has been confirmed. This is shewn by the succession of mammalian forms from the trias upwards, as through the other classes from the earliest dawn of life up to the present day."

This law of gradual and ascending development has been continued from pre-historic times down to the present living and organic world, and has impressed upon it its unmistakable stamp. That science of *comparative anatomy*, or "philosophy of organised forms," as it is termed by Haeckel, a science cultivated with especial predilection in our own time, rests on the attempt to prove the unity of organic forms throughout the animal world, and on the scientific recognition of the existence of a joint plan (?) or fundamental principle underlying all animal forms, and admitting of no modifications or deviations except in a few particulars. An unbroken chain of the most numerous and multifarious analogies binds together the whole animal world from the lowest to the highest. Even our own race, which we have hitherto in our pride regarded as raised so high above the rest of the animal kingdom and as a creation of a different and nobler kind, is far from being an exception to this general rule. Its whole bodily organisation connects it so closely and so narrowly with

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the animals that come nearest to it, being the highest representatives of the vertebrate type, that no really learned man thinks at this day (as people did formerly) of making a special "human kingdom," of it or merely setting man down as a special "order" of mammalia, distinct from the order of the so-called "quadrumana." Nowadays, man is universally regarded as nought but a special "family" of the highest mammalian order, the *Primates* (that is to say, the top forms or lords paramount). "Thus Man shews," says Haeckel, (Anthropogenie, 3rd ed. p. 87) "in all the essential characteristics of his internal organisation such an agreement with other mammals, that comparative anatomy has never entertained any doubt as to his belonging to this class. The whole internal construction of the human body so completely agrees with that of all other mammals, that by the side of it the dissimilarity of the external form weighs as nothing." Even his brain, the organ of his mind and thought, is far from being an exception to this rule; it is a mammalian brain, modified and brought to a higher stage of development in size, shape, internal structure and composition, as has been conclusively shewn by the deep researches of many brain-anatomists, and in keeping with this circumstance it develops the mental capabilities spread throughout the animal world to a higher degree of perfection.*)

The law of gradual transition reveals itself for the third time in the history of the development of individual animal entities. Even at this day, all

*) The facts bearing on this subject and on the controversy on the comparative anatomy of the brain are more fully dealt with in the Author's work on Man, Part II.

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animal forms so strongly resemble each other in the earliest period of their individual procreation, that in order to recognise their fundamental type it is only necessary to refer to this history of their development. It is a very interesting and significant fact that all embryos or germs resemble each other, and that it is absolutely impossible to distinguish an inchoate sheep from the inchoate man, whose genius may perhaps shake the world at a future time. This, indeed, is true to such an extent that an attempt has been made to trace in the development of a given animal, or of man himself, how the embryo in the various stages of its corporeal development represents and repeats the chief types of the groups coming next below it in the animal kingdom, thus yielding, as it were, a miniature of the whole range of existence put in a narrow frame; and this attempt has proved by no means unsuccessful.

"The opponents of Evolution," says Haeckel, "who look upon the gradual development of man out of lowly animal forms and his original descent from a unicellular moneron as a miracle past belief, do not consider that just the same miracle is actually repeated under our own eyes, in the short space of nine months, in the embryonic development of each individual human being. This same cycle of varying forms through which our animal ancestors have passed during the course of many millions of years, has been traversed by every one of us within his mother's womb, during the first forty weeks of his individual existence."*)

*) For further details see the excellent work of J. H. Huxley, "Evidences for Man's Place in Nature," essay on the relationship

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Whoever looks with unprejudiced eyes on these three clearly defined *consentaneous* groups of evolutional facts — the palæontological, the comparative anatomical and the embryological gradations — and throws a glance over the whole — quite apart from all preconceived theories and explanations brought forward hitherto — cannot feel any doubt that in the whole organic world there exists a necessary internal connection, and that one thing must have followed and must follow after the other. Even it we had not lived during the last twenty years, through the great revolution in organic science brought about by the teachings of Darwin, the general result would yet remain certain to every philosophical mind — as it was, in fact, some scores of years since, to the mind of some naturalists, gifted with greater perspicacity than their colleagues, such as a Lamarck, a Geoffroy St. Hilaire, or most of the adepts of the so-called naturalistic school. As far back as 1855, five years before Darwin, the author of this work spoke in its *first* edition of that general result with as much certainty as was possible at that time, and represented the genesis of new species to be a *natural* process, brought about by descent, variation, and development, resting his argument upon considerations generally derived from research in palæontology, comparative anatomy and embryology. Nor did he fail to apply these considerations to the

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of man to the animals next below him: also the Author's "Der Mensch und seine Stellung in der Natur," p. 103 *et seq*, 2rd ed.; lastly Prof. Haeckel's various writings, in which that ingenious author proves conclusively that the history of the embryo is nothing more than an epitome, or a condensed and shortened repetition of the history of the race.

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very "question of questions," and to set forth with a boldness, which drew down upon him a storm of obloquy from all quarters, that "animal descent of man" about which, at present, scarcely any scientists entertains the slightest doubt. As regards the intrinsic causes of these phenomena of transformation, he was, no doubt, obliged to confine himself, in the then state of knowledge, to pointing out, on the one hand, the external circumstances or changing conditions of the surface of the earth, and on the other the possibility of embryonic transformations, expressing at the same time a hope that future researches might throw more light on the question. This hope was fulfilled much more rapidly than he could have ventured to dream; it met with its realisation by the theory which, in such a brief lapse of time, became famous all over the world — the theory of that great Englishman, *Charles Darwin*, who with keen insight and on the strength of an abundance of facts, laid down the following as the *natural* causes of evolution: (1) The struggle for existence; (2) Variation and the variability of species; (3) Transmission and heredity; (4) Natural Selection acting through enormous periods of time. Within a comparatively small number of years this admirable theory has obtained the mastery of organic science; it has especially found acceptance among the younger scientists, who no longer bow to the former conception of "species." In fact, scarcely anyone who examines Darwin's exposition and views without prejudice can seriously deny that species, or creatures organised in a new fashion, *can* and *must* have been evolved in the manner described by him. But it becomes quite another matter

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when the question is propounded, whether this manner, and the variations described by Darwin, are *sufficient* to explain the total growth and the superabundant variety of the organic world. In all probability this is *not* the case, and with a view to this end we must take into account a series of other momentous facts, to which Darwin paid little, if any, attention. Among these facts we encounter, first and foremost, the very essential influence of external and varying conditions of life — such as climate, soil, food, air, light, heat, distribution of land and water, etc. This influence appeared so important to the famous French scientist *Geoffroy St. Hilaire*, that he considered it as sufficient by itself to explain the variation of species. Next we must consider the influences of exercise, habit, necessities, adaptation to changed conditions of life, use or disuse of organs or of parts of the body, the crossing of breeds etc., which influences the Frenchman Lamarck, Darwin's great predecessor and the true father of the evolutional philosophy, who was for so long unjustly decried as a dreamer, and who died in poverty, looked upon as the real causes of the variation of species. Then we must take into account the powerful influence of migration on organised beings, a matter to which a living German scientist, Prof. *Moriz Wagner* of Munich, first drew attention, in connection with, and for the purpose of complementing, Darwin's theory.*) Lastly we must not forget the influence, to which notice was called in the first edition of this

*) See M. Wagner, "Die Darwin'sche Theorie und das Migrationsgesetz der Organismen," Leipzig, 1873.

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book, and which relates to the remarkable phenomena of the so-called alternation of generations, parthenogenesis, metamorphosis, etc., viz. the variations in the germ or the egg induced by external or internal forces, through which in individual cases a change and development of the world of fossil plants and animals may have been brought about by leaps and bounds rather than by a gradual process. These views have been stated and dilated on, at greater length, by one of our most distinguished German scientists, Professor Kölliker of Würzburg, who based upon them his "Theory of heterogeneous generation," to which he subsequently gave the name of "The science of evolution."*)

This general law of variation, transformation and development, whatever may be the causes of the change in individual instances, being once laid down and recognized, we reach a firm standing-ground for the solution of the apparently almost insoluble question as to the "Whence?" of the organic world, and as to the natural causes of that which in the heading of this chapter we have termed "secular generation" or biogenesis, as the sequel of primeval generation. From the least promising beginning and from the simplest organic form-element, which the combination of inorganic materials evolved by spontaneous generation from the lowliest vegetable or animal cells, or even from a yet lower or yet more

*) Consult Kölliker's essay on the Darwinian creation-theory (Leipzig, 1864); further, *Zittel's* "Aus der Urzeit," p. 594; *A. Wigand's* "Genealogie der Urzellen" (Braunschweig, 1872); Dr. *G. Jäger's* "In Sachen Darwins," p. 176; lastly, the author's work on the Darwinian Theory. pp. 178 *et seq.*

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primal organic formation, that whole rich and multiform organic world which surrounds us at this day has developed itself progressively, in the course of endless periods of time, by the aid of natural phenomena. Whatever may have been the nature of the process of evolution as regards the details, however much may yet remain obscure and doubtful in regard to the exact manner in which the organic formation has taken place, this much at any rate we can aver with certainty: *that it has, and must have, happened without the interference of a supernatural power.* If at the present day this creation, while we survey the surrounding Nature, impresses us beyond measure, and if we cannot entirely repel the intellectual impression which points to the existence of a direct creative power, this feeling is in reality to be accounted for by the fact that we see the final results of natural forces that have worked through many millions of years spread out before us in *one* aggregate picture, and that, while we look only at the present, without remembering the past, it is difficult for us to imagine at first sight that Nature has evolved all this out of herself. And yet, there is no getting over it. Whatever may have happened in each individual instance, the general truth rests on irrefutable facts; there is the law of analogies, existing sometimes in the domain of embryology, sometimes in that of comparative anatomy; there are the prototypal organisms; there is the necessary connexion between the external conditions of the crust of the earth, and the origin and form of organic creatures; in fine, the gradual evolution of the higher organic forms out of the lower and lowest, keeping pace with the changes

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in the development of the earth; and there is the paramount fact that the origin of organised beings was not an instantaneous process, but one extending throughout all geological periods. All these circumstances and conditions are indubitable truths, and are wholly incompatible with the idea of a personal and omnipotent creative power; such a power could not have contented itself such a slow, gradual and wearisome process of creation, nor could it have rendered the progress of its work dependent on the stages of the natural evolution of the earth.

The work of Nature, on the contrary, is the very antithesis of such a conception; it is wholly spontaneous, and consisting, as it does, partly of fortuitous and partly of necessary productions, it is infinitely slow, gradual and climacterical. Therefore we cannot perceive in this work anything in the shape of a leap, pointing directly to a personal volition; form links itself on to form and transition on to transition. "Nature," once said Linnæus, "takes no leaps"; and every new discovery, every fact in the fabric of Nature, furnishes an additional proof of the truth of his assertion. Imperceptibly the plant glides into the animal, the animal into the man. Despite all efforts, we have not yet been able do draw a hard and fast line between the vegetable and animal kingdoms, widely separate though these divisions of the organised world appear, and there is no probability that we ever shall be able to do so. On the contrary, the latest researches on the *protista*, which bridge the gulf between the two kingdoms, and from which they have developed in two different directions, clearly shew

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that these are in turn half animal, half plant, and that the distinctive features of the two types clearly emerge only in the higher stages of development. Like the *physique*, the intellectual capacity rises. step by step and gradually, from the lowliest and least noticeable beginnings, to ever higher and more perfect developments, until it reaches what is as yet its highest perfection in the sensation and volition, the imagination and ratiocination of man. The supposed insurmountable boundary between the human race and the animal world, which, despite all the progress of science, is still so generally believed in, is fully as much a myth as any other strict division of nature, whether man be looked at from a physical or an intellectual point of view; and if, in the progress of civilisation, man has reached to a level on which he towers as much above his brute relations as God did formerly above man, he owes this to nought but that same gradual evolution, rising stage by stage, by which the whole organic world has been procreated. Geologists set down the age of the human race — as mentioned in an earlier portion of this chapter — at one hundred thousand years at the very lowest, adding, however, that this figure is probably very much below the mark. The *history* of the existence of the race, on the contrary, in its civilised state, is but a few thousand years old. What immense periods of time must therefore have elapsed ere man could have reached such an intellectual height as to feel the need and devise the means of transmitting his experiences to posterity by word and writing, *ad perpetuam rei memoriam*, to use the standing formula of the See of

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Rome. And what right have we to trace back to supernatural causes or to a creative will whatever may be done and has been accomplished by the civilised man, who at present stands at the top of a ladder of a hundred thousand years, and has behind him and beneath him the whole work of countless generations? If we but remember his humble origin, which is lost in the impenetrable darkness of prehistoric ages, we shall look at the matter in quite a different light, and come to perceive that such a result could only be obtained by long and slow development and by continued improvement. In those earliest times there is no doubt that the highest of organised creatures, in his whole physical and intellectual being, was much more closely allied to the brute than to his present form and condition. The oldest human bones and human skulls, dug out of the very bowels of the earth, exhibit for the most part rough and undeveloped forms, far exceeding, in their resemblance to the brute, the most brute-like of existing races of men; and yet it must be remembered that these fossils belong to periods much further removed from the real genesis of man than the time in which they were deposited or buried is from the age we live in. To what extent the formation of the skull of Europeans has improved even within historic ages will be told in detail in a later chapter.

If it be assumed, then, contrary to all scientific ratiocination, that the hand of the creator superintended all these phenomena, at all times and in all places, *scattered in space and time,* we come to general pantheistic notions, and in that event it becomes impossible to deny that this relationship still exists,

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seeing that the evolution of the earth and of the vegetable and animal species, that live thereon, has not ceased, but is going on at this day, the same as it did heretofore. In that event it must also be assumed that no lamb can be conceived or born without the co-operation of that creative power; that no child can cut a tooth without divine assistance, and that every gnat that lays its eggs depends on the care of that supreme power for the hatching of its progeny. But science has long since proved to demonstration that these processes are natural, mechanical, and spontaneous, and has overruled every thought of a supernatural interference. And thus, these circumstances may be used by us in support of the views expressed above, for it is justifiable to infer from the natural character of the present processes of the organic world, their equally natural origin, and *vice versa*. We must go on as we commenced. "A supernatural origin implies a supernatural continuation." "He who cancels *one* law of nature, cancels them all." (L. Feuerbach.)

"Though self-contained as an individual," says *Burmeister*, "the earth remained in a definite immutable relation to its environment, and whatever occurred upon it, independently of that relation, was accomplished by it of its own accord; for there never was, and even at this day there does not exist, any power on earth save that which is inherent in the earth itself. By that inherent power it developed; its results extended exactly as far as this power acted. Where the terrestrial forces disappear, every terrestrial action also ceases and determines, and what it could not bring forth has never existed, nor will ever be brought forth."

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Never has science gained a more brilliant victory over those who appeal to another world and a supernatural principle for the explanation of existence, than it has in geology and palæontology; and never has the human mind more emphatically vindicated the rights of Nature, even under difficulties which can only be understood by those who are thoroughly familiar with the history of science. Nature knows neither a supernatural origin nor a supernatural continuation; she, the all-bearing and the all devouring, is her own Alpha and Omega, her own generation and death. By her power she brought about the so-called creation, and created man as the crown thereof; by her own power she will take him back again, when his dwelling-place, the earth, has completed its natural term of life in the endless cycle of worlds. May not therefore this race of man die out and disappear, the same as so many other races recorded in the history of the organic world died out and vanished after having attained a certain goal? and may not another and perhaps a more perfect race take its place? No one has known, no one knows, and no one will ever know it, save those who survive!*)

*) On the possible future and the further physical and intellectual development of the human race, in the light of the now almost generally received belief in the theory of origin and development, the author has written fully in the third part of his work on Man and his place in Nature. There, as well as in the frequently cited work of the author on the Darwinian Theory, will be found further statements bearing on the matters dealt with in this chapter. Consult also the essay on the organic scale in the author's work, "Aus Natur und Wissenschaft," and the chapter on creation in "Natur und Geist."

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THE FITNESS OF THINGS IN NATURE.

(TELEOLOGY.)

Design is introduced into the world by the reflecting reason, which is thereafter startled by a miracle of its own creation.

Kant.

It can no longer be doubtful that the world progresses in a manner that has no resemblance to human design; nay, that its essential method is such that, measured by the standard of human reason, it can only be regarded as the blindest chance . . . . Development "according to Nature" is one special case out of a thousand. It is the exception, and this exception is created by that very same Nature whose apposite self-preservation is admired by your short-sighted teleologist.

F. A. Lange.

Each inapposite condition is an untenable condition. Each development is the removal of something which ought not to be, of something inapposite, and a transition towards something apposite that does not exist yet.

Dü Prel.

Strife is the parent of things.

Heraclitus of Ephesus.

One of the chief strongholds of those who ascribe the genesis and preservation of the world to an all-ruling and all-organising creative Power, has been and still is the so-called *fitness* in Nature. Each flower that unfolds its many-colored petals; each gust

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of wind that chases away a cloud; each star that lightens the night; each leaf that flutters in the air; each wound that heals; each thing, each phenomenon of Nature; all these afford the faithful teleologist or the seeker after fitness an opportunity of admiring the unfathomable wisdom of that Higher Power. Modern investigation and natural philosophy have shaken themselves tolerably free from these empty and superficial conceptions of design, and leave such childish views to those who are incapable of liberating themselves from such anthropomorphic ideas, which unfortunately still obtain in school and church to the detriment of truth and of science.

If matter, as has been shown in our earlier chapters, cannot exist nor be thought of without force, motion and form, it stands to reason that the genesis and destruction of individual forms, existences, and institutions of nature are a necessary and obvious result and product of physical existence or of the interaction of natural forces. Not less obvious and indubitable must it appear that these natural forces, by their mutual millionfold reactions, must determine and limit each other, so that at length an apparent order and design must have arisen, which if we look at with human eyes and measure by the standard of human institutions, without taking into consideration its original causes, must nessarily appear to have been extrinsically called into being by a conscious reason ordering things with perfect consciousness. We omit to note *in limine*, that there could be no other result, owing to the very nature of the case. and that inapposite and unfitting things and institu-

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tions, or even attempts at creating such, must have perished by their own inherent defects in course of time; or, in other words, that an apposite institution is only one case among a thousand inapposite or less apposite ones, which, from their very unfitness, were incapable of surviving. Therefore, as *Kant* already observed, it is to our reflecting reason, which deals only with what it has before its eyes and not with the past, and which judges by the standard of its short experience, derived from human activity, that this apparent design is to be traced, which is really nothing more than the necessary result of the interaction of natural materials and forces, and of their development in course of time which brings everything to a certain level by preserving those things which have vitality in them and expunging those which have not. Nature, as Dü Prel correctly remarks, is her own physician, and her regular working itself represents its own remedy, by which what is unfitting is weeded out and none but the fitting things are allowed to subsist. It is the organic or living things which are more particularly capable of the most varied modifications and adaptations by virtue of their pliable character. They transmit to their descendants, in ever increasing ratio, the characteristics thus obtained, while the succeeding generations, in their turn, go on acquiring new properties. In this way we arrive at an ever increasing evolution towards forms and conditions imbued with ever increasing vitality, or, in other words, becoming more and more fitting and apposite.

This view is so simple and so clear that it must necessarily commend itself to sober and unprejudiced

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minds, even without any further scientific investigation. In point of fact, it was clearly expressed, as far back as the first century after Christ, by *Lucretius Carus*, the author of the famous didactic poem "*De rerum naturâ*," who says: —

"For truly the origin of things has neither been led up to the present order by wise pre-ordainment, nor have its motions been regulated by the compulsory force of law; but shaken by countless impulses, constantly changing, endless in numbers it drove through the universe, and at length, after attempting every form of motion and of composition, it finally arrived at the present order of things."

But even apart from this general consideration, we are not justified in speaking of design, knowing, as we do, things only in the one form and condition in which they lie before our eyes, and having no conception of what they would look like if their condition were quite different from what it is. In order to form a competent judgment, we ought to be in a position to compare the order of things of this world with that of one quite differently constituted, and this of course, is an impossibility. But whatever the arrangement of the world might be, it would always appear to a certain extent designed, provided we were able to exist in it. In fact this is so much the case that the most varied conditions under varied circumstances appear designed to us, according as our individuality has become adapted to them. To the Northerner the cold seems pleasant and useful, and to the Southerner the heat; the Arab loves the desert, the sailor the ocean, the huntsman the woods and mountains, the agriculturist the fields, the towns-

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man houses and men. Thus, to every one of these only that seems fitting which is agreeable to him on account of his individual and personal tastes or wants, or which is beneficial to him or in keeping with his idiosyncrasy. Moreover our reason need by no means content itself with the existing reality, lying before it. For where is there an institution or contrivance of nature but might be imagined better, or more appropriate in one way or another? Nay, there are natural contrivances of a very complicated and highly developed kind, in regard to which it may be scientifically proved that gradual development and adaptation has never yet imparted to them that degree of perfection which they would have attained had they been created with a preconceived view to fitness. Thus, that apparently most skilfully designed organ of sight, the human eye, appears to the outsider as a marvel of fitness, as a arrangement for seeing, bespeaking the highest and most matured wisdom in its design; but upon its being examined by the scientist, there are brought to light a number of faults and imperfections, such as chromatic dispersion, spherical aberration arising from the imperfect construction of the lens, astigmatism or imperfect adaptation for simultaneous vertical and horizontal vision, springing from a defect in the curve of the cornea; besides the blind spot, the shadows cast by the vessels, the incomplete transparency of the media, and so on. If a human optician were to supply an instrument made in the same way, it would, as *Helmholtz* remarked, be at once rejected as a bad piece of workmanship. The reason of it all lies in the fact that the eye — like all organs and contrivances in

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the plant or animal body — has passed through countless gradations of imperfection, by the gradual addition and retention of small improvements, from a simple, sensitive nerve lodged beneath the skin, to its ultimate and highest development, and even this highest development is by no means complete even in the most perfect eye. In this respect, comparative anatomy furnishes us with the most conclusive proofs, shewing that the earliest beginnings of the organ of sight in the lowest animals are not even represented by nerves, but by small gatherings of red or violet pigment-cells, to be found in the skin at the fore-part of the body. Exactly the same or similar things occur in connection with all the other sense-organs, which were originally nothing more than portions of the external skin, through which nerves of sensation were spreading, and which developed gradually, in the course of many millions of years, by dint of practice, division of labor, adaptation and inheritance, until they arrived at their present degree of perfection. This gradual development of the organs of sense may be pursued even at this day through all its stages in the incubated hen's egg, as parts of the outer covering of the body or epidermis, or simple epidermal cells, are gradually transformed to the characteristic sense-cells. On the lowest rung of the scale of life, e. g. in the protista and the infusoria, the senses are actually at work without there being any special organs of sense or nerves. "These facts," *Haeckel* remarks, "prove most conclusively that the most perfect organs of sense are not the factitious production of a preconceived plan of creation, but that, like all other organs of the animal body, they

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are the unconscious product of natural selection in the struggle for existence."*)

What paramount influence the mere external agency of light has wrought on the development of the organ of sight appears more particularly by the well-known facts relating to the blind cave-animals, which, led by chance into the absolute darkness of their caves and being compelled to live there, have gradually lost their eyes, these having become degraded to mere rudiments. On the other hand, fishes and other denizens of the sea have the larger eyes the more they are wont to live in the dark depths of the ocean, for in the struggle for existence natural selection must have favored those who could best collect the sparse rays of light by possessing a larger eye.

It results from all this that eyes were not bestowed upon us in order that we might see with them, any more than we have received feet in order that we may walk with them. Rather do we see and walk *because* we have eyes and feet. The function is not the origin, but the result of the organ. Sight did not exist *before* the eye, nor speech *before* the tongue, but the reverse. On the same ground we cannot say that the stag and the doe have received long legs in order that they may run fast; but they run fast *because* they have long legs. The mole has short spatulate feet for digging; if he had not it would never

*) Further details may be found in Haeckel's "Ueber Ursprung und Entwicklung der Sinneswerkzeuge," Kosmos, vol. IV, pp. 20 *et seq.* (Or in the collection of translated Essays, "The Pedigree of Man and other essays," London, Freethought Publishing Company.)

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have occurred to it to burrow in the earth. Things are as they are because they have so developed among millionfold mutual frictions and interactions; had they developed or been able to develope otherwise, we should not have regarded them as less fitting or apposite. Animals in the North have a thicker fur than those in the South, and in winter they have thicker hair or feathers than in summer. Is it not more natural to look upon such phenomena as the necessary result of external influences, and in this particular instance as the result of thermal conditions, than to believe, as the teleologist does, in a heavenly tailor who sews the winter and summer garments of every animal? It is, in point of fact, a well-known thing that in prolonged low temperature the skin produces a stronger growth of hair; thus, for example, the elephants and various species of the rhinoceros, now only found in tropical countries, are almost naked, whereas their antediluvian relatives of the cold North, the mammoth and the woolly rhinoceros, were clothed with long thick hair. To this must be added the influence of the struggle for existence, discovered by Darwin, that is to say, the ceaseless mutual competition carried on by all organised beings both against each other and against the conditions of life, a struggle which resulted and results in the permanent preservation of such forms only as are distinguished from their fellows by some advantage, however slight it may be at first, and which hand down this advantage to their young for gradual further development. Thus the protective colors of many animals, as the green of insects, the white of the ptarmigan, the brown of animals living on the bark of trees, the grey hue,

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resembling sand, of desert animals, and so on, are the result of selection in the struggle for existence, for while animals of other colors soon succumbed to their enemies, these survived and transmitted their favorable peculiarity to their young. Again, in cold countries, animals with a thick fur are more likely to survive than those with thin; they transmit this peculiarity to their young, and it increases from generation to generation, thus giving them the greatest advantage and to the superficial observer the impression of a divine or intentional contrivance, whereas a more thorough observation shews that these are but the natural effects of natural causes. Therefore, those things that now exist in the world are but the remains of an infinite number of beginnings and of countless processes of development. Whe should not omit to notice in connection with this that the views so admirably put forward by Darwin were known long since to the most ancient Greek philosophers, and that the Greek philosopher *Empedocles* (450 B. C.), who is now often termed the ancestor of the Darwinian theory, taught with marvellous ingenuity that in the moulding of matter into form many irregular forms may have previously existed, which were partly unable to maintain themselves, and but gradually, as they became more advantageously moulded and thereby imbued with more vitality, attained a fitting constitution.

These considerations are also calculated to refute the objection that the non-teleological view of the world leads us to mere *chance*, whereas chance could never produce suitable forms. As far back as two-thousand years ago, *Cicero* contended in opposition

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to the pantheistic philosophers of his time: "Let any one toss up a number of letters ever so many times, they will never form a poem, such as the Iliad or the Odyssey." Of course they will not — for such a contingency would be entirely out of the question, and would be like a single price among countless blanks. But a chance, of this kind does not occur in Nature, in which everything proceeds in final resort in a natural and regular manner. What we still designate as chance, merely depends on a concatenation of circumstances, the internal connection and final causes of which we have as yet been unable to unravel. "To chance," says already the famous '*Système de la Nature*', "we ascribe those effects of which we cannot trace the connection with their causes. — Order and disorder are not in Nature." Therefore, the alternative "God or Chance" which is so often presented to us by teleologists, has no real existence. There is a third course, and this is the gradual evolution of what is suitable in the natural course of things by the already described processes of selection, adaptation, etc. Under existing natural conditions, quite an incommensurable number of fitting mechanisms, forms and contrivances, may be imagined or realised, of which some actually spring into existence, although it does not follow that they must be the most fitting that could be conceived. Sufficient if they be fitting enough as to be able to exist under certain conditions. This view thoroughly coincides with the actual facts of the matter and with the constantly changing phenomena and conditions, as we find them in the natural history of the earth and of the universe. Let people leave off, then, meeting

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the arguments of the defenders of the existence of natural laws with the weak and insipid commonplaces about chance or about the tossing-up of letters; such objections only bespeak either want of knowledge or want of reflexion.

If, after all this, it becomes perfectly obvious that Nature does not act from a conscious design or plan, but obeys a blind necessity, it is no less self-evident that, working as she does, she necessarily calls into life and being a number of things which must appear to us — if we judge only by the standard of fitness — as utterly perverse, useless, absurd and imperfect. In fact, if once we begin to look at Nature from the point of view of fitness, it is easy not only to discover numbers of such aimless and useless things, absurdities and imperfections, but also to demonstrate that Nature, when interrupted in her blind action by external or internal difficulties, becomes guilty of the most startling blunders and perversities. She is oftentimes unable to conquer the smallest obstacle in her path, or to smooth it away in a befitting manner, and in the course of her utterly involuntary action she entangles herself every moment in quite unnecessary or insoluble difficulties and perplexities, which would inevitably be steered clear of by a conscious reason, or even by an unconscious activity guided and determined by considerations of fitness.

Above all, no one can deny that Nature, in her blind creative impulse, has given birth to a number of beings and things which cannot be regarded as designed for their own sake, and which rather destroy than promote the natural order of things and the good of the whole. Upon this ground, the existence

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of *mischievous* animals and plants has always been a thorn in the flesh of the teleologists and the advocates of a religious conception of the world, who have tried in every imaginable way to explain the *raison d'être* of these destructive beings. In this they have utterly failed, as proved by the results of those religious systems in which the Fall, or original sin, is represented as the cause of the anomaly alluded to. According to the theologians *Meyer* and *Stilling* (Blätter für höhere Wahrheit), injurious reptiles and mischievous insects are the result of the curse which smote the earth and its inhabitants, and in the monstrous form and appearance of many of them we behold to some extent the image of sin and destruction! In keeping with this it is alleged that they are a later creation, and not part of the original one, because their very existence is bond up with the destruction of vegetable and animal matter! In old German paganism these animals were regarded as wicked *elves*, from whom sprang all diseases, and who owed their origin to the worship of the demons on May-night. These curious attempts at an explanation shew the utter inability of man to explain on grounds of usefulness the existence of these mischievous, harmful and disgusting creatures, or to bring them into accord with the working of a benevolent and beneficent Providence. On the other hand, we know that perfectly harmless and very useful animals have died out or are in course of becoming extinct, without Nature finding any means of preserving their existence. Yet mischievous creatures, such as field-mice, are gifted with such fertility that their extinction is not within the range of possibility. There is scarcely

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any limit to the prolific power of those microscopic organisms which are the causes of so many terrible diseases, and which inflict on man such incalculable injury, sometimes directly, and sometimes by the destruction of useful plants. Locusts and migratory pigeons form flocks which darken the sky, and which spread ruin, death and famine over the unhappy lands on which they rest from their flight.

"He who only seeks wisdom, design and appropriateness in Nature," says Professor *Giebel*, "had better turn to the natural history of the tape-worm, to try his ingenuity upon. The entire object of its life consists in the production of eggs capable of development, and cannot be attained except through the sufferings of other creatures; millions of eggs perish aimlessly; some are developed, and the embryo finally becomes evaginated and grows into a sucking and reproductive scolex, the young of which produce eggs and putrify in the excreta of other beings. Here we have nothing of beauty, design or wisdom, in the ordinary human construction of the terms."

Whence — we may fairly ask of the teleologist — come the hosts of diseases and of physical evils? Why should Nature inflict such frightful cruelties and horrors, on her own children and creatures, daily and hourly, by means of floods, earthquakes, lightning, fire, hail, volcanoes, storms, etc.? Why is the existence of millions of creatures possible only by their destroying other millions of their fellow-creatures or making them suffer in the cruellest way imaginable? Can it have been divine goodness and mercy which imparted cruelty to the cat and the spider, and endowed man himself, the so-called crown of creation,

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with a nature that makes him capable of practising every description of the most dastardly brutality and atrocity on his own race?

Of course, theologians lay the flattering unction to their souls that all this is only the result of the Fall, and has been factitiously brought into an originally pure and uncorrupt Nature by the moral ruin of mankind. They do not know, or do not want to know, that natural laws have been the same at all times, and that palæontology can bring forward countless and irrefutable instances of bones of men and animals having been injured by disease, though belonging to a period prior the supposed date of the original sin. Disease is as old as organic life, as evidenced moreover by internal causes, and a *Paradise* that is not reached by evils and disease is, to the clear eye of the scientific investigator, nothing more than one of the myths hatched by the childish fancies of nations, the outcome of the unsatisfied longing of the human mind for a better state of things.

The colors of flowers, the teleologist is wont to say, exist to delight the eyes of man. But how long did flowers blossom without being seen by a human eye, and how many are there that bloom at this day in inaccessible spots, or at the bottom of the ocean where no eye but that of the diver can light upon them? Moreover, it is in evidence that fully one half of all the plants in Creation possess no beautiful, many-colored blossoms; and Darwin, by his investigations, arrived at the remarkable conclusion that flowers as a rule are only gaily-colored in order to attract the insects which aid their fertilisation, while those flowers which are fertilised by the wind are

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never bright-colored. Therefore no flower would be endowed with a beautiful color, if such colour were not beneficial to the flower itself and had not been evolved, by way of predilection, in the struggle for existence. This calls to our mind the fact that very many flowers are so badly contrived that the *conditio sine qua non* of their fertility, *i. e.* the union of pollen and ovule, is either prevented or rendered difficult in every possible way, and that their propagation is rendered possible by mere fortuitous circumstances, such as rain, wind, insects, etc. Why is this? There are so many aimless or useless parts and organs in the vegetable world, that the famous botanist *Schleiden* was led to say: "The boldest imagination is paralysed in the end, in seeking any definite conception of design in the manifold forms and configuration of plants."

The same thing holds good of animals and of men, in whose physical structure numerous aimless contrivances and organs, permanent or temporary, may be shewn to exist. No one can tell the use of the tail of the human embryo, or of the forms of fœtal transition, or of the rudiments of opposite sexes in male and female mammals, such as the male mammary glands, or of the so-called appendix vermiformis, or the muscles of the ear, or the inside of the foot, or the tonsils, or the thymus, or the semilunar of the eye in man, or the clavicle of the cat, or the wings of some birds which are useless for flying purposes, or the teeth of the whale, etc. etc. These belong chiefly to the great class of *rudimentary* or degraded organs, which are explicable by the theory of descent, but which offer an insoluble problem to the teleological

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conception of the world and to the theory of creation, being, as they are, not only useless and aimless, but in some cases actually injurious. "If everything that is fit in this world had been created by a rational spirit, the long persistence of rudimentary organs would be inconceivable; for God, who was able to create the whole universe in six days, would surely have been able, in an equal space of time, to get rid of an organ which had become useless." (G. A. Schneider.) *K. Vogt* states that there are animals which may be set down as complete hermaphrodites, that is to say, possessing perfectly developed organs of both sexes, and yet incapable of self-fertilisation; the rule being that two individuals are necessary for reproduction, while self-fertilisation is the exception. "What end," he pertinently asks, "does such a contrivance subserve?" Again, why must some aquatic birds remain content with a small extension between their claws, while animals which never swim are furnished with skin between their toes? And what is the good of the existence of thousands of drones in the realm of bees, which only seem to live in order that they may be killed by their labouring sisters? What is the use of the large clumsy beak of the Brazilian toucan, which makes it impossible for the bird to take its food directly, compelling it, as it does, to throw it up into the air and then to catch it deftly with its open beak near the root, so as to be able to bite or swallow it? The sting of the bee or the wasp, which, according to the teleological view, was given to these creatures for their defence, serves as a rule, when used, to bring about the death of its owner! The natural history of insects, above all, yields so

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many facts that go dead against the theory of a design, that Professor *Graber* (Die Insekten, Munich, 1879, II, p. 569) says: "In the course of the development of insects we not only meet with a number of processes which, to put it mildly, can scarcely serve to illustrate the idea of design; but there are also numerous structures and organs which may, with absolute certainty, be pointed to as perfectly useless." And again (p. 45): "The entire morphology of insects is a network of clear and circumstantial evidence against the notion of a predestined and previously intended fitness of the organs."

The fertility of many animals is so great that if they were left to themselves, they would in a few years crowd the seas and cover the land right up to the housetops.*) What is the object of such an arrangement, seeing that there is neither space nor food enough for such crowds of animals? Or is it consistent with the idea of a creative spirit that such

*) The bacteria, which are microscopic organisms of the minutest kind, multiply by the simple binary division of their bodies, in such a manner that from one bacterium two new creatures are formed in one hour, four in two hours, eight in three hours, sixteen in four hours, and so on. Assuming this process simply to go on, then, according to Professor *F. Cohn's* calculation, there would be within three days as many as 47 trillions of bacteria in existence, and within *five* days the creatures evolved from one germ would completely fill the whole 928 cubic miles of the Ocean! Yet, as already stated in an earlier chapter, these creatures are so tiny that 633 millions of them occupy but one cubic millimeter, and 636 milliards of them only weigh a gramme. The queen bee can produce 100,000, the female termite 12 million descendants every year; and even less prolific insects, increasing in geometrical progression, would soon fill the world with the progeny of a single individual.

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countless germs or complete creatures should merely be created for the purpose of immediately perishing again in the pitiless struggle for existence? Even the human race, despite its slow rate of progression, would, but for the fact of immemorable lives coming to a premature end, double its numbers in a quarter of a century, although the earth has neither space nor food enough for such multitudes of human beings.

One of the strongest arguments against the pretended design in the actions of Nature is afforded by malformations and monstrosities. With what object did Nature allow a mammary gland to grow on the shoulder of a man 34 years of age, as recorded by Dr. *Klob* of Vienna? or give a woman *three* well-developed breasts, as seen by Dr. *S. Johnson*, (Lancet, and Gazette des Hôpitaux, 1861, Nr. 81)? or give grown men *four nipples* instead of the normal two — a case that has been observed twice by the author in his own practice, and of which 105 examples were collected in 13 years by Professor Leichtenstern of Tübingen? (Virchow's "Archiv für pathol. Anatomie und Physiologie, Vol. 3, Part II.) With regard to monstrosities, the unsophisticated human mind has been so little able to reconcile them with belief in a benevolent creator, that they were formerly regarded as a sign of the wrath of the gods, and even at this day uneducated people often look upon them as a punishment from heaven. The author of this book saw in a collection of a veterinary surgeon a new-born kid, which was perfectly developed in every part, except that it *had come into the world without a head!* Professor *Depaul* presented to the French Academy a human fœtus without a head and without

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limbs, with breast and abdomen imperfectly formed, and the place of the head on the trunk represented by a tuft of hair. This misshapen creature grew in a corner of the decidua. (Compt. rendus de l'Académie des Sciences, March 1875.) From a teleological point of view, is there any more glaring absurdity to be imagined? Professor Lotze of Göttingen surpasses himself when he says in speaking of monstrosities: "If the brain is wanting in a fœtus, it would be only rational in a power with a free choice to suspend its action, as this want cannot be compensated. But since the formative forces carry on their work in order that a creature so purposeless and wretched, and so opposed to the idea of generation, may exist for a time, this appears to us to be a striking proof of the fact of the design of the final result depending on the disposition of purely mechanical and determined forces, the action of which, once begun, proceeds straight on without thought and without reflexion according to the law of inertia, as long as no obstacle happens to stand in its way," etc.

This is plain speaking, and by the side of it, it seems scarcely credible that the same author should elsewhere contend that "Nature, *distrustful* of the inventive power of the mind, has furnished the body with certain mechanical contrivances," the effect of which is, *e. g.*, that a foreign body should be expelled from the trachea by coughing. If it were possible that such philosophical views, ascribing *distrust* to Nature, should be generally accepted, there would be an end to every real investigation into Nature, and nothing would remain but passive faith. That the same author, who is actually *regarded as an authority,*

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should utter, in *one* breath, two theorems that are so diametrically at variance with each other, proves the philosophical confusion and inconsistency of our time.*) If Nature according to Lotze, had reason to distrust the inventive faculty of the mind, she would have had infinite opportunities of making preventive provision for certain contingencies; she might have arranged things in such a way that bullets should rebound from the body, and that swords should hit without cutting. A foreign body in the trachea may *perhaps* be ejected by coughing, but a foreign body in the æsophagus may bring about suffocation by causing excessive nervous irritation at the top of the trachea. What a preposterous arrangement! and yet there is no trace of distrust towards the inventive faculty of the mind which has invented pincers and dungeons. Every day and every hour the physician has opportunities of convincing himself of the helplessness of Nature, among diseases, wounds, miscarriages, etc., and of her often unsuitable, perverse or unsuccessful efforts to heal. There would indeed be no need of physicians if Nature were to act with a set purpose. Inflammation, gangrene, mortification, wasting, and similar processes are chosen by Nature and are fatal, when she might have attained the object by simpler means and might have effected a cure. Is it fitting that a fœtus should fix itself and be developed outside the uterus, the place assigned to it by nature? yet such cases of extra-uterine pregnancy occur frequently enough, and result in the painful death of

*) *Karl Vogt* in his well-known work, "Köhlerglaube und Wissenschaft," calls Herr Lotze a "speculating Struwwelpeter," an epithet that could scarcely have been better chosen.

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the mother; worse still, that in such cases of extra-uterine pregnancy, labor-pains, that is efforts to expel the child from the uterus, should set in at the normal period, while there is really nothing to be expelled? There is no *healing power* in Nature, in the sense in which the phrase is generally used, any more than there is a vital power in it. In pursuing the direction once imposed on it by definite natural formulæ, the organism often adjusts morbid disturbances in its further development. At other times it does exactly the contrary, and following its necessary and determined activity it entangles itself in a number of insoluble and perfectly unnecessary difficulties. The existence of definite specifics against specific diseases is often quoted as a striking proof of the accuracy of the teleological conception of the world. But there are no such definite specifics as heal certain definite diseases with certainty and under all circumstances, and might therefore be regarded as designed for the curing of such diseases. All rational physicians now deny the existence of so-called *specific* remedies in the sense alluded to; on the contrary, they hold that the action of a medecine does not consist in a specific neutralisation of the disease, but must be explained in quite another way as depending chiefly on accidental circumstances, reposing on a far-reaching causal nexus of intermingled conditions. Hence we must abandon the idea that Nature has allowed certain herbs to grow as remedies for certain diseases — a view that imputes to the creator an utter absurdity, for it implies that he created an evil with its antidote, instead of leaving both uncreated.

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To return once more to the subject of monstrosities, we must note that such can be *artificially* produced, by injuring either the ovum or the fœtus. Nature has no means of meeting this attack and of remedying this injury; on the contrary, she obeys the fortuitous impulse, and moulding in the false direction brings forth — a monstrosity. Is it possible not to recognise that here we have nought before us but factitious and merely mechanical processes? Can the idea of a conscious creator, ruling matter with a purpose, be reconciled with such phenomena? Is it possible that in its action of producing fitting formations, the forming hand of the creator can be arrested or turned in a wrong direction by the capricious finger of man? It does not matter whether man interferes with the working of such a hand at an earlier or at a later stage; nothing is gained by assuming that Nature has only received from outside an original impulse towards the formation of designed works, but accomplishes these works by mechanical means. For the designed impulse must necessarily involve the designed result. And where shall we seek this designed impulse, since the natural circumstances under which the natural beings arise are fully known to us, and since we know that traces of a creative force external to the natural order of things are to be found nowhere?

Nature accomplishes many alleged objects in a clumsy, roundabout fashion, while it cannot be denied that if it had only been a question of attaining these objects, the result might have been obtained in a very much easier and simpler way. The greatest pyramids of Egypt and other gigantic monuments are

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built out of stones which owe their existence to the calcareous shells of minute organisms. The freestone out of which nearly all Paris is built, consists of the shells of small animals, of microscopically minute creatures belonging to the foraminiferæ, of which some two hundred millions are contained in one cubic foot. The time necessary for the formation of these stones must be reckoned by myriads of years; they are now useful to man and appear to him to be a proof of the care of a designing nature. But the disproportion between the means and the end stands out in this instance in startling clearness. Such formations, in which the product of the silent working of many thousands of years appears suddenly before our eyes, seem to the ordinary mind marvellous, supernatural and factitious, but the investigator's eye sees in them nought but the slow, necessary cycle of Nature, which is complete in itself.

Man is wont to look upon himself as the culminating point of creation, and to consider the earth, with all that lives and moves therein, as created by a beneficent power for his use and dwelling. A glance at the history of the earth and the geographical distribution of the human race might teach him rather more modesty. How long did the earth exist without him! how long did all the beauties of sky and earth shine without there being a creature gifted with reason, to behold and admire them! Why should all those endless pre-human ages have rolled away, if man were actually the be-all and the end-all of creation? "Man," says *Helmholtz*, "is wont to measure the greatness and wisdom of the Universe by the duration and advantage it promises to his

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own race; but the past history of the globe in itself shews how brief a spell in its duration is the existence of the human race." But not only is his existence on the earth limited in time, but so also is his distribution in proportion to the extent of the earth's surface, of which only a comparatively small part may be turned into fairly comfortable dwelling-places. By far the greatest part of the earth's surface consists of deserts of water, sand and ice. Two-thirds of it are covered with water, and of the remaining third some parts only are suited for men to dwell in. Even these as a rule cannot be inhabited without toilsome cultivation and a permanent ruinous struggle against unfavorable natural conditions and against hunger, disease, climate, wild beasts, etc. Why should so many wasted sunbeams brood daily over the huge sandy solitudes of Africa, while the poor and miserable men of the Polar regions are pining away in semi-darkness and everlasting cold? Why should there be drought in one place, and inundations in another? why famine in one and superabundance in another? why fertility here, and barrenness there? Why should frost, rain, vermin, the scorching heat of the sun and other similar agencies destroy whatever man, struggling for dear life, imagines that he has wrung from the elements by gigantic exertions and superhuman efforts? Must not he be actually bereft of his senses who seriously contends that the earth has been fitted up by an all-wise and all-merciful providence as a becoming dwelling-place for man? Only by the uttermost exertion of his physical and mental faculties is man enabled to eke out a bare existence on earth, jeopardized all

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the while by thousands of dangers. And these faculties of his were not bestowed on him by a benevolent creator, but are the final result of that slow and toilsome evolution by natural means, which has been described in an earlier chapter.

Let us see what view was taken of these things by the unsophisticated mind of an adept of the most free-thinking and most widely diffused religious system in the world, which is Buddhism. When a Christian missionary said to the late king of Siam, *Maha Moughut*, who himself wrote on theology, that the Most High let fall the rain in order that men might cultivate their fields, he answered: "But the rain falls irregularly; in some places there is too much of it, and in others too little. A great part of it falls into the sea and on mountain ranges. Sometimes the water carries away towns, while at other times there is not even enough to make rice grow. Many parts of the earth are utterly barren and unfitted for the support of human life." Upon being told that God had created the earth for man and man's good, he pointed out that there were hidden reefs on which ships foundered, and fiery mountains which only brought destruction on man. He spoke of diseases and epidemics, and hearing that these were intended by God to punish men for their sins, he replied that epidemics were caused by foul and poisonous air, and that the rich could escape from the punishment by leaving the infected places. The Buddhist sage could not conceive why the Most High should have human qualities and passions, nor why he should only reveal himself to a privileged few; nor why error and false doctrines should exist; nor how each human germ

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could be transformed into a never-dying creature? When he was told that *woman* was God's second creation and his master-piece, he answered: "Then hold her in honor and not in subjection." Buddha, he said, taught very different things altogether, and sought to make men happy and wise on earth, instead of referring them to a phantastic world to come.

Let man just take counsel with himself and enquire whether, if God created him with a view to happiness, well-being and knowledge, he might not have formed him in a far more perfect and suitable fashion? Why should not man have four eyes, one for each of the four sides of the body, instead of the two with their limited range? Why cannot he fly like the birds? Why has he not the swift legs of the stag, and the muscular strength of the lion? Why cannot he live on air, instead of working the greatest part of his life tied to the ground, merely to satisfy the insatiable cravings of his stomach? Why has he no more than five senses? and why can he not perceive the phenomena of electricity and magnetism by means of a special sense, the same as he does those of light and heat? Why is his knowledge so very circumscribed? and why is his life so short, and his intellectual capacity so limited? Why do thousands upon thousands of natural obstacles stand in the way of the free working of his powers? Why is he left a prey to tyranny, malice and every kind of injustice? Nobody can satisfactorily answer these questions from the teleological or theological standpoint, whereas they meet with the most plausible solutions when looked at from the point of view of a natural order of things, proceeding from a gradual and spontaneous evolution.

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Modern science (see *Helmholtz*: "Ueber die Wechselwirkung der Naturkräfte, 1854, and the writings of *Clausius, Thomson, Tait, Stewart,* and others) has calculated, or believes to have calculated, that as there was once a period in which the earth was without organic life, so there must and shall appear also in a future which, so far as human conception goes, is as yet infinitely and immeasurably remote, a period in which the present forces of Nature will become exhausted and be consigned to temporary inactivity, through the constant loss of heat and the gradual equilibration of temperature; causing everything that lives on earth to return to night, to death and oblivion. On astronomical grounds also there can be no doubt that just as our whole planetary system originated in time, it must necessarily perish within a definite period, however remote that period may be; for the sun, the source of all terrestrial force, will cease to shine, and the planets, owing to the gradual diminution of their orbits, will re-unite themselves with the sun, their cradle and their grave, in the chaos of the primal elements.*) All great things wrought by man on earth must then necessarily be consigned to the limbo of eternal oblivion. In the face of such a fact let us just ask, what is the meaning of all the high-sounding philosophical phrases of universal purposes to be effected in the creation of man; of the incarnation of God in history; of the story of the earth and of the human race as the spontaneous revelation of the Absolute; of the eternity of conscious-

*) Further details will be found in the Author's "Licht und Leben," in the Essay: "Der Kreislauf der Kräfte und der Weltuntergang."

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ness; of the freedom of the human will, and so on? What is the whole life and working of man in the face of this everlasting and irresistible course of Nature, induced by inflexible necessity and inexorable regularity? It is but the brief play of an ephemeron, hovering over the ocean of eternity and infinity!

It must not, however, be forgotten that though our little earth with its inhabitants may perish, it by no means follows that the fate of the immeasurable and everlasting universe should likewise be sealed. Nay, at the very time when our own race dies away in cold and desolation, we have a right to assume that on thousands upon thousands of other spots in the universe the conditions of things will have reached a culmination point from which a new race can take its departure, similar or analogous to ourselves in the fundamental principles of physical and intellectual formation, and doomed, like ourselves, to eventual individual and collective extinction. Therefore, the destruction of our earth with everything on it does not seem to signify any more in the universe, than the death of one individual does on our own earth; and the wave of life which passes over our earth is, as *Proctor* says so forcibly and so beautifully, "but a gentle ripple on the sea of life within the solar system, and this sea of life, again, is itself nothing more than an insignificant wave in the ocean of the eternal life of the universe." Like the wife of Ulysses, who undid at night what her industrious fingers had wrought by day (Dü Prel), Nature amuses herself with an eternal building-up and destroying, the beginning of which is like its end, and the end like the beginning. Thence, as *Spiller* thinks, by a "continual perfecting in the

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aggregation of atoms (as actually occurs on the earth. *Author.*) there might possibly arise an improvement in organisation and in conditions of life" which would enable us to imagine that a gradual progression from the imperfect to the perfect and from the lowlier to the higher, as we have learned from the history of our earth, would take place within definite periods in the never-ending regions of the universe. But for us men, who shall never see nor experience this, it must be sufficient to know that the minute particle of the eternal cycle of the universe which we are able to survey, strives upwards within certain limits towards perfection, and that we by our very existence must contribute our share to it. There is no other object in the existence of the individual or in that of the universe but existence itself; and each thing and each life discharges its duty fully and thoroughly by taking part within its individual sphere in the eternal life of the universe, which moves in an unbroken orbit:

Willst Du, dass sich an einem Bild
Der Welt Geheimniss Dir enthüllt,
So sieh' auf einem Blatte weiss
Gezogen einen dunklen Kreis.
Und wie sich in der runden Bahn
Das End' dem Anfang füget an,
So füget sich im Weltenall
Das End' dem Anfang überall.
In ew'gem Laufe ohne Ruh
Strebt Alles seinem Anfang zu,
Und aller Anfang wünscht zu sein
Da, wo das Ende fügt sich ein.
Drum glaube nicht, dass einst die Welt

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Aus einem Nichts geworden sei.
Und nicht, dass einst zusammenfällt
In Nichts der Welten Einerlei!
Denn Alles, was geboren wird,
Ist ewig schon gewesen da,
Und nicht der kleinste Staub verirrt
Sich in des Todes Arme ja.
Du selbst bist nur ein kleiner Theil
Der unbegrenzten Ewigkeit
Und nur für eine kurze Weil
Gebannet hier in Raum und Zeit.

Drum streitet, Thoren, ferner nicht,
Ob Ihr im Geist unsterblich seid,
Denn keines Todes Macht zerbricht
Der Dinge Unvergänglichkeit,
Die Alles, was da ist und lebt,
In einem ew'gen Kreise führt
Und, wo sie zur Vernichtung strebt,
Die Flammen neuen Lebens schürt.
Unsterblich ist der kleinste Wurm,
Unsterblich auch des Menschen Geist,
Den jeder neue Todessturm
In immer neue Bahnen reisst.
So lebet Ihr, gestorben auch,
In künftigen Geschlechtern fort,
Und dieser ewige Gebrauch
Verwechselt nichts als — Zeit und Ort!*)

(Wilt thou have revealed to thee as in a picture the secret of the universe? Then gaze at a dark

*) Consult on the matters dealt with in this chapter the statements on design in the Author's "Natur und Geist"; on rudimentary organs his writings on Darwin and on man.

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circle drawn on a blank sheet. And as in its orbit the end joins the beginning, so is the end one with the beginning throughout the universe. In the eternal cycle everything ceaselessly strives towards its commencement, and every beginning yearns to be where the end joins it. Therefore dream not that the universe has arisen out of nothing, nor that the worlds will collapse into nothingness. For whatever is born has been in existence from eternity, and not the tiniest speek of dust ever loses itself in the arms of death. Thou thyself art but a minute portion of the boundless Eternity, and art but for a brief spell bound up within Time and Space.

Therefore quarrel no longer, ye fools, as to whether you are immortal spirits, for no power of death can break the imperishable chain of things; whatever is and lives moves in an eternal circle, and wherever it struggles towards annihilation it but fans the flames of new life. Immortal is the tiniest worm; immortal also is the mind of man, which each fresh storm of death drags into ever new roads to life. Thus, dead, thou livest in future generations, and this eternal use changes nought but Time and Space.)

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MAN.

There are many marvels — but there is no greater marvel than Man.

Sophokles.

Men originate in brutes and must become Gods.

L. Jakoby.

God was my first, Reason my second, Man my third and last thought. Man alone is and shall be our God. Outside man is no salvation.

L. Feuerbach.

The same laws which in the preceding chapters have been shewn as ruling in the *macrocosm*, or universe, rule also in the *microcosm*, or the world of man, in whose existence, being and thinking the universe is, as it were, reflected and contemplated. That man with all his eminent qualities and faculties is not a work of God but a product of Nature, like all his fellow-creatures, and has proceeded from a natural and gradual evolution and self-education — this momentous and notorious truth can only be doubted at this day by the ignorant or deliberately obstinate. During the short space of scarcely more than forty years the researches on the early history of the human race on earth have grown into a comprehensive science and have shewn that mankind has behind it

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a past in comparison with which the historical period is but very brief. As regards the biblical myths and fairy-tales about the world and man having been created some 5000 or 6000 years ago by a creative *fiat*, they are really too childish, too radically at variance with the most notorious facts and results of the whole geological, archæological and archæogeological science, to be made the subject of a serious controversy. Not only has it been shewn by the results of countless excavations, as well as by the investigations of Egyptologists, based on the reading of hieroglyphic scrolls, that in the venerable land of the Nile an admirable and highly developed culture and civilisation existed at a period to which the Bible only traces the creation of the first man; but the researches of archæogeology as the union of geological and archæological science is called, have proved beyond doubt that man was a contemporary of the huge mammals of the Diluvian age, which are now either extinct or have emigrated from Europe; that he existed in one of the earlier periods of the formation of our earth, during which part the surface of the globe had a very different geographical configuration and was subject to different climatic conditions from those that exist at the present time. Nay, there are a number of theoretical arguments, the full exposition of which would take up too much of our space, and which, taken in conjunction with the results of many archæogeological researches — though there may yet be some controversy on the inferences to be drawn from these — make it appear in the highest degree probable that the existence of man, or rather of his earliest beginnings on earth, goes back to a time

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that must be computed by geological, and neither by historic nor prehistoric standards of measurement. By all appearances it will not be long before the existence of the so-called *tertiary man* — that is to say, of a human or anthropoid creature, existing in a later or earlier division of the last great period of formation of the earth — will be looked upon with as much certainty as is now the existence of the prehistoric or diluvial man which had been doubted for such a length of time. Of course this would not affect the ancient belief in the principle of perfection, according to which man is the last and as yet highest outcome of the organic process of evolution or graduated progression on the stage of existence; for although, as scholars are now forced to admit, the antiquity of man on earth must be measured by hundreds of thousands of years, this period is yet but exceedingly brief when compared with the many millions of years which the earth, together with her organised inhabitants, has lived through, in her gradual progress of development; so that the existence of man on earth must upon all hands be considered as comparatively very short. Then again, modern science ranges among exploded fables that idea that used to be entertained on the strength of religious myths, and according to which man came out of the creator's hand as a ready-made product, endowed with all the qualities of his race. The unchangeable principle of the order of the world, based upon natural and mechanical causality, acts and works in the same way in the gradual genesis and formation of the highest of all organised beings as it does in the formation of the least and lowliest. However obscure and incompre-

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hensible the appearance of man on the earth's surface may have seemed in former times, and however necessary it may have been thought to explain or elucidate what an English scientist designated as the "secret of secrets" by the aid of a great miracle or of a supernatural act of creation, it has now become obvious to all men of science that the lofty form of man only owes its origin to a slow and gradual uprisal from the animals next below him, and that the beginnings of, and tendencies to, all his high physical and intellectual qualities and faculties are clearly present in the forms of life beneath him. The well-known lines of demarcation upon which the idealistic philosophy of the past laid so much stress, and which, in the opinion of many learned men, proved the existence of an abyss between men and animals which could never be bridged over, have been shewn, by closer investigation, to be one and all of but a relative and not an absolute nature, and they can all be explained by gradual development, improvement and spontaneous evolution. Therefore man does not stand *outside* nor *above* Nature, but wholly and thoroughly in her midst, and the great and mischievous error that all Nature was created for his sake and for his use and enjoyment must be looked upon as exploded, just the same as science has for ever done away with the antiquated notion of the importance of our little earth as the centre of the universe. Of course it is difficult for most men to emancipate themselves from the impressions wrought by an education permeated with spiritualism, and to grasp the great truth of the real place of man in Nature; but this cannot prevent the eventual triumph

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of true knowledge. "Gather together all these phenomena," says *Carus Sterne* (Werden und Vergehen, p. 340), "and their convincing force is so great that he who, in the face of them, impugns man's descent from animals, lays himself open to the reproach that he is not capable of drawing an inference of the simplest nature." "Such objections as the absence of transition-forms can" as Professor *O. Schmidt* (Descendenzlehre und Darwinismus, p. 275) cogently remarks, "only be raised by *dilettanti*, to whom the realm of living things as a whole remains a sealed book."

Those who believe that they ought to trace the origin of man to other than natural causes, will find it quite impossible to explain why the original stock of men should have branched off into so many different races and species, and why the innumerable languages should differ from one another so very widely as to make it is impossible to conceive that they could all have sprung from a common root or primitive tongue. All investigators into this subject are now agreed in that the *formation of races* must have preceded the formation of languages; that is to say, that mankind, though existing originally in a single form, but in many pairs, had been split up into different races a long time *prior* to the origin of language; nay, it must be thought possible or probable that the same race, even *after* its divergence from the common stock, evolved various different languages. From this it follows with certainty that articulate speech, the distinguishing mark of humanity, which in the opinion of eminent scientists must necessarily have preceded and not followed the evolution of higher human intellectual activity and civilisation, *was not in*

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possession of the first man, and that the Biblical Adam, if he existed, must have been an ἄλαλος or speechless savage, occupying a position much nearer to the brutes than to man as he is now. To this very day there are still plenty of speechless tribes, whose faculty of language is not raised much above that of animals, and even among ourselves we still find speechless human animals; these are our sucking babies, and children brought up in the desert or in solitude, who, like animals, utter sounds but have no language. Now it is impossible to conceive that the gift of language, if bestowed or transmitted by divine wisdom upon man as originally created, would ever have been lost, especially within the short space of from 5000 to 6000 years, allowed by the biblical cosmogony. But if no reason can exist without language, it is plain that the first man can have been no rational being, that is to say, no man in the present sense of the word; he was rather a hybrid creature between man and beast, and from a savage anthropophagist has gradually worked his way up to his present position, through very protracted periods of time, by the well-known natural influences, and all the while in a constant struggle for his existence. To the civilised and cultured man, who has always his own form before his eyes, it may seem difficult to descend in thought into those wild depths of his primal and natural origin and condition: but a glance at so many of his human brothers who have lagged behind or stood still on the road towards a higher human condition, and a rapid survey of the great results of pre-historic science will be amply sufficient to make him forget the childish fable about

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the creation of the ready-made man. Nor will his sense of human dignity be affected by this, if he remembers the admirable words of a French writer: "It is better to be an ennobled animal than a degenerate Adam," and if he bears in mind that among all the forms brought forth by the working of natural forces through long and toilsome evolution, he is, after all, the highest and, comparatively speaking, the most perfect. Not as the humble and submissive slave of a supernatural master, nor as the helpless toy in the hands of heavenly powers, but as a proud and free son of Nature, understanding her laws and knowing how to turn them to his own use. does the creature of modern civilisation, the Freethinker, appear; being no longer, as *Brookes* called him, that "unhallowed medium between angel and beast," but the incarnation of the mightiest effort of Nature; though on the one hand he partakes of all the weaknesses and imperfections of his animal nature and origin, on the other he is raised up above this nature of his and becomes the ruler of the world, by virtue of the enhanced powers of his highly developed nervous system.

In fact, neither the enervating influences of a factitiously fostered fear of God, nor the bewildering phrases of scholastic philosophy have been able to debar the human race as such from taking its due place at the head of the natural order of things, and man from wielding a dominion, circumscribed only by his own impotence, over the mass of his fellow-creatures, as well as over Nature herself, so far as he understands her and knows how to curb her. Of those very forces of Nature which have produced man, he has,

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by the power of his reason, made his willing and powerful servants, and this he will do in the future in ever progressing ratio.

Of course, this has not always been so, and only by a long and weary training through study and experience has man, after surmounting countless steps of error, reached that pure clearness of free and unprejudiced thought in which all scientific minds now move or ought to move. Deep ignorance of the laws of the Nature surrounding him, and a very intelligible fear of the natural forces pressing on him and threatening him, in conjunction with a belief in the continuance of the principle of life after death, which was incomprehensible to him, must necessarily have led the earliest man, when he came to consider a little, to anthropomorphic ideas and fancies of a divine and supernatural government of the world, which belief being fostered and worked upon by ambitious priests, has brought so much misery and such great trouble on poor suffering humanity. "O unhappy race of mortals," exclaims *Lucretius Carus* in his famous poem, "that ascribes such things to the Gods and imputes to them such embittered wrath! What grief have they not brought upon themselves, what injuries upon us, and what tears upon our posterity!"

This unnatural idolatry flourished most exuberantly in the dark days of mediæval mysticism, when people imagined all Nature filled with angels and devils fighting one another, and sought relief from the misery of earthly existence in the joys of an imagined paradise. "I would not give up one moment in heaven for all the possessions and joys of earth, even though they should last for thousands upon thousands of years,"

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said *Luther*, the great Reformer, who, despite the great merit he acquired in setting man's mind and conscience free from the yoke of Rome, remained a consummate priest at the bottom of his heart. In the words quoted he clearly expressed the views and notions of those who only behave themselves on earth in order that they may be rewarded a thousandfold in heaven, and who act like gews lending money at usury. "The pious," says Börne, "look at heaven as a court, and look down with contempt on all those who have not the entry, like themselves."

If ever such views could become general and practical, so that life and thought should be ruled by them, then man would cease to strive after earthly improvement and perfection and would subside into a passive faith, turning up his eyes like a dying duck in a thunderstorm. "For," as *Ludwig Feuerbach* tersely and cogently remarks, "if we are born for heaven, we are lost for earth." When man has once got used to regard himself as a poor, miserable sinner, who can only escape eternal damnation by unceasing genuflexions and undignified self-abasement, it is obvious that there is an end not only of human dignity and human pride, but also of human energy and vigour. If we allow supernatural wisdom and power to lord it over us and to provide for us, then an existence worthy of the true end of humanity, or of what the Scotch catechism calls the chief end of man, becomes an impossibility. "The malicious devil," says Luther, "the enemy of God and Christ, endeavours to allure us to think and care for ourselves, so that we may presume to usurp God's office, which is to care for us and be our God."

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Fortunately such views have usually prevailed rather in theory than in practice; and the sound sense of human nature, which is not entirely to be stifled by any dogma, as well as the irresistible pressure of life, have guarded mankind as a whole from the ruinous influences of a conception of life divorced from the terrestrial; a conception which, on account of its spiritualistic convulsion, must be regarded as the most inveterate enemy of material culture and elevation, and which has inflicted, and continues to inflict, infinite injury on man. But there will be less and less of this as man advances in knowledge and intellect, and as he learns to understand that the aim and object of all human effort must not be the contempt, but the knowledge, control, and utilisation of Nature. Towards this the whole thought and working of civilised mankind are actually tending at the present day. In practical life men give the lie direct to their faith, which has sprung from Oriental fatalism and despair of life; a faith to whose diametrical and irreconcilable opposition to all intellectual and mental progress and to all efforts directed towards the joy and happiness of life, no thoughtful person can shut his eyes. "In practice," says *L. Feuerbach* very correctly, "all men are Atheists; they deny their faith by their acts." Only the vast power of habit and of education directed into a religious channel can explain and render it conceivable, that this antithesis is so little appreciated in general, and that the majority both of the learned and the unlearned, as though spellbound within a magic slumber, continue to feed their minds with long-exploded nursery stories and fancies, while all around them the sun of truth

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and knowledge scatters its rays, as it were, from every corner of contemporaneous literature.

It has been reserved for our time to complete theoretically and scientifically the victory long since won in practical life by the *human* principle over the *divine*. As a star of the first magnitude we are met here by the name of *Ludwig Feuerbach*, the philosopher *par excellence* of emancipated and self-contained humanity. To this deep-thinking philosopher, who traces all ideas of God back to man's invention and self-idealisation, the human being is at the same time the *highest* being. "The Godhead of the individual," he exclaims, "is the revealed mystery of religion, and the *negation* of God is the *position* of the individual." But when once nations have advanced so far as no longer to build up their God from *sensual*, but from *intellectual* conceptions, then the word "God" expresses no longer an idealisation of the whole man or a deification of the human entity, but only a blending together and involution of the highest intellectual properties of human nature, that is to say the idealised existence of human reason. "God, unanthropomorphic and stripped of human characteristics, is nothing more than the essence of Reason."

Feuerbach has thus arrived at his peculiar standpoint, from which he seeks with a singular abundance of knowledge and perspicacity to vindicate the natural right of man, which has seemingly been swallowed up in a vortex of dogmatic quarrels, priestly ignorance and philosophic chiaro-oscuro. To man he now traces every intellectual quality; and anthropology, or the knowledge of man in the widest sense of the word, is to him the crown and blossom of every science and

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a perfect substitute for religion and philosophy. In fact, the great and unexpected development of this science during the last ten years has shewn the Radical thinker to have been in the right, and has proved most conclusively that man, evolved by natural means as the highest product of Nature and of the natural order of things, need not make any but his own nature, and his own idiosyncrasy the starting point of his most ideal conceptions and efforts. What is common to the knowledge of all men and of all times, and being common, advances in constant progression, is God or rather the idealised existence of human reason, transmuted into the idea of God. Not "to" God, but "towards" God will man have to rise in the future, if he remains loyal to Feuerbach's thought, and in doing so will verify the words of our motto, that men have indeed originated from the brutes, but are destined to become Gods.

It does not detract from the merit of Feuerbach, but on the contrary adds to the greatness of his idea, to find that in earlier or more ancient schools of thought views had been given utterance to which are analogous and cognate to his. Thus it is said of the Chinese religious teacher *Lao-Tse* (translated, "the old child") — a contemporary of the great Confucius, who was born some 565 or 604 years before Christ, and who wrote the famous book *Tao-te-king* (the way to virtue, or the book on force and action) — that he called the highest being *Tao*, a word which philologists render by "Reason," or "Universal Reason," and that he identified reason in man with the reason of the universe and with the highest being itself; yet, in his system there is no trace of an intimation of

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the existence of a personal God. Tao loves all beings and cares for all, *but does not want to be their lord and ruler.* It is eternal and has no earthly desires. Lao-Tse, from the purity and elevation of his teaching, has rightly been styled the Chinese Christ; and this teaching of his so much resembles that of the Christian Church that the Jesuit missionaries of the 17th and 18th centuries very properly held that the secret of Christianity must have been revealed to the Chinese five hundred years earlier than to the Jews. But as though a curse rested on all religion, Lao-Tse's disciples and successors, by the contemptible Shamanistic impostures, brought contempt and disrepute upon themselves and the Tao doctrine too, just as the successors of Christ did upon his teachings.

The contemporary of Lao-Tse, the great and more sensible moralist *Confutsee* or *Confucius*, strove, by banishing from his system all that was supernatural, to direct human thoughts and actions entirely to the earth; it was he who laid down the famous maxim which makes all other moral commandments unnecessary: "Do unto others as you would that others should do unto you." He never spoke of a creator, nor of a supernatural order of things; and a pious regard for one's ancestors is the only precept of his religion which goes beyond the range of earthly life.

The famous natural religion of *Buddha*, the great founder of the rationalist creed of the Hindoos, which will be dealt with at greater length in a subsequent chapter, is at the bottom nothing more than the deification of human nature; and to this are linked a large number of similar and kindred ideas and apophthegms on the history of human thought. The

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same thought inspired *Thomas Müntzer*, the famous leader of peasants, when he said to his followers: "The Holy Ghost is our reason and our understanding."

And these alone are in reality the two things, which man should consult and on which he must rely, on turning his glance to the future that lies before him; which future, in all probability, portends much greather things than the past ever worked. When we come to consider how short a period has been occupied by the development of the civilisation of mankind, as compared with pre-historic periods, and to what a very small portion of the earth's surface this development extends; when we further bear in mind what vast horizons are being opened up on all sides by the advance of science, knowledge and industry, and how the comparative rate of progress increases with progress itself; and finally, when we remember how much we still retain in our refined life of the crude tendencies and instincts of our barbarous past, and how the savage "struggle for existence" handed down to us from animal life still rages as bad as ever, though in a modified shape, we feel compelled to admit that our civilization is still altogether in its infancy, and that we have as yet traversed but a small portion of the path marked out for us. Increased means of conquering the material obstacles which Nature and life place in our way; the growth of culture and knowledge, combined with enhanced success in contending against ignorance and superstition; the lessening of the evils that flesh is heir to; the abolition of war, of poverty, of every method of men taking undue advantage of one

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another, and the substitution of the principle of universal human love and universal peace among nations for the ruinous struggle for existence — these and many more that are interwoven with them should be the aims and objects of man's aspiration in the future. "We stand," says Lubbock, (Prehistoric Time, vol. II, p. 297), "in reality but on the threshold of civilisation. Far from shewing any indications of having come to an end, the tendency to improvement seems latterly to have proceeded with augmented impetus and accelerated rapidity .... There are many things which are not as yet dreamt of in our philosophy; many discoveries which will immortalise those who make them and confer upon the human race advantages which, as yet, perhaps, we are not in a condition to appreciate. We may still say with our great countryman, Sir Isaac Newton, that we have been but like children, playing on the sea-shore, and picking up here and there a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lies all undiscovered before us. Thus, then, the most sanguine hopes for the future are justified by the whole experience of the past."*)

*) This matter has been treated by the Author at much greater length and much more thoroughly than has been possible in this condensed chapter, in his work on "Der Mensch und seine Stellung in der Natur"; oder, "Woher kommen wir? Wer sind wir? Wohin gehen wir?" 2d ed. 1872. (Leipzig, Th. Thomas.) In this treatise he dwells chiefly on the antiquity of man, the animal origin of man, and his probable future development. An English translation of this work, by W. S. Dallas, was published in 1872 by Asher and Co., 13 Bedford Street, London.

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BRAIN AND MIND.

Mind and the totality of the living active nerve-centres of an animal or human existence are perfectly identical notions for the unprejudiced natural investigator. Outside the nerve-centres there is no mind.

Prof. C. B. Brühl.

The soul is the brain in action, and nothing more.

Broussais.

From matter we rise to mind by means of the brain.

H. Tuttle.

That the brain — that soft organ which fills the interior of the cranium, and which, next to the liver, is of all the organs of the human body the densest and therefore comparatively the richest in blood-supply — is the organ of thought, volition and sensation, and that the latter cannot be conceived without the former, is a truth about which hardly any physician or physiologist can be in a doubt. Science, daily experience, and a number of the most telling facts, of necessity force this upon their conviction. Therefore, in sketching the subjoined outline of facts, we are less actuated by the desire of imparting something new to them, but rather to give some clearer notions of the subject to the general public, which often finds insoluble problems in the simplest and clearest truths of natural research. It is strange that in this matter people have at all times stubbornly refused to acknow-

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ledge the irresistible power of facts; but this is easily accounted for, and considerations of a certain *amour-propre* and egotism are decidedly at the bottom of it.

The brain is the seat and organ of thought; its size, its shape, its development, the manner or grade of its composition and formation, and the arrangement of its individual parts, stand in a definite relation to the quality and quantity of the psychical and intellectual performances thereof. The important science of comparative anatomy is here of the greatest value, shewing, as it does, how, throughout the animal kingdom, from the lowest up to the highest animal and to man himself, there exists a definite and gradually progressing proportion between the qualitative and quantitative condition of the brain. Man who, by virtue of his intellectual faculties, is admitted to be far above the collective animal world, has also — apart from a few exceptions which shall be more closely examined by and by — the largest brain, *absolutely* and *relatively*, among all living beings. Although the bulk of brain possessed by a few animals, known as the largest now in existence, such as the whale, the elephant and the large species of dolphins, surpasses the brain of man, this apparent exception really arises from the greater size of those parts which do not represent either intelligence or capacity for thought, but serve the nervous system of the body as centres of movement and sensation, as well as of unknown nervous action, and have necessarily a greater development of mass on account of the greater number and thickness of the nervous fibres in connection with them; whilst the parts of the brain concerned with the function of thought are in no animal equal in

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size, form, and relative composition to what they are in man. Therefore, quite another result follows when the *relative* weight of the brain, *i. e.* its weight in relation to that of the body, is taken into consideration. In this respect also man (with a few insignificant exceptions) surpasses the whole animal world, and so much is this the case that, whilst in man the weight of the brain amounts to from one-fiftieth to one-thirty-fifth part of the weight of the body, in the dolphin it amounts only to the hundredth part, in the elephant to the five-hundredth, and in the whale to the three thousandth part of the aggregate weight of their respective bodies. If this relative proportion is calculated upon the mass of the body, then (according to Leuret) the average weight of brain to each *ten thousand* parts of body-substance is: in fishes, 1·8; in reptiles, 7·6; in birds, 42·2; in mammals, 53·8; in man, 277·8. These figures sufficiently shew the enormous gradual increase of the mass of brain in the vertebrate sub-kingdom, corresponding to the rise in the intellectual scale. Even among the articulata — whose highest divisions in perfection of organisation and intellectual endowment are far above the lowest divisions of the vertebrata, though the latter stand above them as a whole — the *bees* and *ants*, whose extraordinary and almost miraculous intellectual capacity has become proverbial, and their nearest relations, are distinguished by a brain highly developed in shape and composition, and very large in proportion to the size of their bodies.*)

*) See "Mind in Animals," by the Author. (London, Freethought Publishing Company.)

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However, the intellectual value of the brain, both among men and animals, must not be computed exclusively by its size, that is by its size as a whole, which is a very imperfect standard of its intellectual capacity, but also and very much more so by the proportions of its shape and composition. "Not the quantity only, but also the quality of the nervous tissues," says *Valentin* (Textbook of Physiology) "and the consequent amount of energy, and of the reciprocal action of the individual elements, forms the measure of the proportionate value of intellectual activity."

In this respect also comparative anatomy and physiology have shewn that man stands higher than all other creatures; for instance in man the hemispheres of the cerebrum, the external layer of which — the *grey matter* — is to be regarded as the peculiar seat of intellectual activity, are far more highly developed than in any other animal in comparison with the cerebellum. When the brain is looked at from above, they completely cover the cerebellum, while this is not the case with the brain of any brute. Closely connected with this development of the cerebral hemispheres is the greater development of the famous *convolutions* of the brain, which cover the external surface, disposed in a regular system of winding, interceding furrows, and which have no other use than that of giving the greatest possible extension and anatomical complexity of arrangement to the grey matter of the brain; this substance covering the whole surface to the depth of several lines, and the two fundamental elements of the nervous system, *fibres* and *cells* (ganglionic or nervous centres), being so arranged in it as to afford the greatest possible

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number of material points of contact between them. This is all the more necessary since it is the function of the fibres to convey to the brain impressions from without and from the body itself, while the ganglionic or nerve-cells, having received these impressions, work upon them, and with the aid of the efferent and the intercommunicating fibres transmute them into reflective or volitional impulses. The fibrous tissue of the brain is dead white in color, whilst, wherever nerve-cells or ganglionic masses are found with them, the brain-substance is of grey-rose color, partly because of the cells and partly from its greater vascularity; hence the distinction between the *grey* and the *white* matter of the brain. This grey matter has also been termed the *brain-mantle,* partly because it covers the brain like a mantle, and partly because of its peculiar disposition in folds. This arrangement increases the mass or extension of the grey matter, which covers all the folds of the windings to the before-mentioned depth, thus obtaining *more than twelve times* the superficial extent, without increasing the size of the head or the arch of the skull to an unnatural or excessive proportion.

This brain-mantle, as we have said, is without any doubt whatever the portion of the brain to which are entrusted the higher mental or intellectual functions, such as thought, imagination, consciousness, sensation and volition; while the underlying white or fibrous tissue only serves as an organ of conduction, and the islands of grey matter in the interior of the cerebrum serve as centres for the nervous action of the brain, in its capacity of superintendent of the whole nervous system.

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If the human brain, as shewn in the foregoing, surpasses all animal brains in absolute or relative development of mass, except in the few above-mentioned instances, it is still more above them in the internal arrangement of its individual parts, especially in the development and arrangement of the grey substance and of the convolutions, which in extent, depth, number, multiformity and asymmetry or irregularity of disposition are approached by no animal brain; perhaps a few exceptions to this should be made in favour of the brain of the large anthropoid apes, though these again labour under other and important defects. The lower we descend in the animal scale, the more rapidly do the numbers of convolutions decrease. Thus, the brain-surface of fishes and amphibians is quite, and that of birds *almost* smooth and without convolutions. The lowest orders of mammalia have also smooth brains, or shew but the merest trace of convolutions; and it is only in apes, elephants, dolphins, dogs, carnivora and ruminants that they obtain a larger development. On the other hand, the brain of bees and ants is very rich in convolutions.

The same differences that exist between human and animal brains are also to be noticed in comparing individual human brains with each other, both in regard to the convolutions and the increase of surface obtained thereby; it is easy to prove by countless examples that intellectual endowment or capacity for achievement is like a mathematical function of the development of the convolutions and of the grey matter of the brain. The is true not only of individual races and nations, but equally of individual specimens of mankind. The subject has been

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treated in a remarkable work by that painstaking scientist Dr. *Hermann Wagner**), from which it clearly appears that *the superficial extent of the brain increases with the intellectual power*. Thus, Wagner found the aggregate area of the brain of an orang-outang he measured to amount only to a fourth of that of the average human brain, while in the case of a manual labourer the surface of the brain was some fifty square inches less than in the case of two scientists. The convolutions of the brain of Beethoven, the great musician, were, according to Dr. J. Wagner's report, "twice as deep and numerous as usual." On the other hand *Longet* shows that in the brains of idiots, or creatures who are born imbeciles the convolutions are less deep and the grey matter is less thick than in normal brains. A child, also, despite the large size of his brain in comparison with that of his body, has but very imperfect convolutions, and only develops these after reaching a certain age. Prior to the ninth month of pregnancy the convolutions are not even visible; until then the human fœtus has a smooth brain, like that of the lower vertebrates.

We should, however, fall into a serious error if we rated the intellectual value of a brain *only* by the conditions above-mentioned, by its size and the number of its convolutions; much more depends on the details of its internal structure and its chemical composition, so that if an individual brain be deficient in *one* direction, the defect may be compensated by advantages in other directions. Especially does it appear averred from the unanimous statements of

*) "Massbestimmungen der Oberfläche des grossen Gehirns," 1864.

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brain-anatomists, that the physical density or firmness of the mass of the brain is beyond doubt of very great importance, so that the brain of an intelligent and clever person is denser and firmer than that of a stupid and weak-minded one. So also is the brain of higher races, which have advanced in culture, proportionately more dense, firm and compact than that of lower or savage ones. It is well known that the brain of the child in comparison to that of the adult is remarkable by its softness and want of density, owing to the greater percentage of water it contains. The microscopic peculiarities of the brain, the commencement of very indistinct fibres, the difference between grey and white matter, the large blood-supply, the furrows, etc., only become recognisable in the course of time and in proportion as the intellectual power increases. Conversely, as the brain grows older and the intellectual power declines, the grey substance absorbs more water and the brain returns to a condition similar to that of childhood. In doing so, the brain of old people subsides as a rule into a state of atrophy and shrivelling-up; gaps are formed between the convolutions which formerly were close together, and these gaps become filled with water; the substance of the brain itself becomes more tenacious, the color deeper grey, the blood-supply less, and the convolutions become smaller. The weight of the brain, having rapidly increased up to the 25th year of life, and having reached its maximum volume between the age of forty and fifty, now begins to fall off. Everybody knows that in keeping with what we have said, reason comes with years, and also departs with years.

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"The greatest thinker of his age," says *Tuttle*, "may in one hour's illness lose all his intelligence; in advanced age he enters a second childhood, as helpless and simple as the first. With the decay of the body decays also the reason, and with the last breath it expires, the same as a lamp does without oil, flickering feebly." This is exactly the reverse of what would happen if, as so many think, the spirit were a thing independent of the body, and the spiritual powers increased in proportion as the body drew nearer to its dissolution.

From what has already been said it may readily be inferred that the proportionate thickness of the grey matter is of the highest importance in connection with intellectual capacity, and this thickness varies very much among animals and men. Thus, Dr. J. Jessen*) perceived to his great surprise that the brain of a female idiot, called Nasmer, 23 years old, shewed numerous well-developed convolutions on the surface, but he soon found the solution of the difficulty when, on disseckting the brain, he saw that the grey matter had become atrophied, apparently from disease contracted in early childhood, and thence it had become very thin and narrow. Jessen's researches also prove that a deficiency of superficial development of grey matter, brought about by the smallness of the cranium, may be made up for by a greater development in thickness. This in itself explains — apart from many other compensating agencies — how it is that a comparatively small brain may exceed in

*) "Untersuchungen über die Beziehung zwischen Grosshirn und Geistesstörung," Archiv für Psychiatrie, 1875. Vol. IV. Part. 3.

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mental power a comparatively large one, just as a small nose may exceed a large one in olfactory power. This also seems to explain, at least partially, the capacity for intellectual performances of some animals, such as dogs and others, which are possessed of comparatively small and otherwise less perfectly developed brains.

Similar results may be looked for from differences in the *chemical* composition of the brain, a matter about which, up to the present time, very little trustworthy information has been supplied. But it is known that the brain of children, old men and animals, compared with that of adults, is very poor in those peculiar phosphoric fatty or fat-like substances which play so great a part in the chemical composition of the central portions of the nervous system, and are on the whole found in greater quantity in proportion as the animal or the man stands higher in the intellectual scale. From the more recent investigations of *Borsarelli* it appears that the average amount of phosphates in the brain is far greater than had been supposed, and that among all the organs of the body the brain contains by far the greatest amount of phosphates, twice as much, for instance, as muscle. Hence the great proportion of free phosphoric acid and of alkaline phosphates in brain-ash. This observation is confirmed and supplemented by the researches of Dr. *H. Byasson*, which have shewn that wearisome intellectual labour is followed by the presence of considerable quantities of alkaline phosphates and sulphates in the urine. Dr. *L'Heritier* has also shewn that in old age and in a state of idiotcy the phosphorus contained in the brain is but one half in

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quantity of what it used to be, and recedes in point of fact to the proportion contained in the brain of an infant. Violent passion or excitement leads to an accession of alkaline phosphates — originating from the brain and nerves — in the urine, while conversely a decrease of these substances is noticeable when there are functional disturbances in the activity of the brain. These facts place it beyond doubt that the phosphoric compounds present in the brain have a special significance, and suggest the conjecture that there exists some definite ratio between these and intellectual work. They shew further that the literary outcry raised at the time over *Moleschott's* well-known phrase: "Without phosphorus no thought!" merely proved the scientific ignorance of the criers. They also bring to our knowledge the important fact that all foods containing phosphorus in the form of *lecithine* (which is a component of brain-substance) are specially devoted to make up for the substance wasted by intellectual work, and that the nerve-strengthening power of an article of food increases with the amount of phosphorus present within its nitrogenous components.

When all these facts are borne in mind, it becomes clear that the intellectual value of a brain depends not merely on its absolute or relative size, mass, and weight, but on quite a host of morphological, histological, chemical and physical circumstances, the accurate valuation of which presents serious difficulties in each instance. But there is yet another coefficient to take into account, and one of the greatest importance, too, which, as a rule, is wont to be more or less overlooked in judging this momentous question;

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and this is the great influence wrought on the capacity of the mental organ by *breeding, exercise* and *training*. This influence is so great that a man with a comparatively small or badly-formed brain and small talents, but who has had these talents thoroughly cultivated, may give an impression of greater intelligence than a man with an excellent brain and many talents that have not been properly brought out and trained. This is the less surprising as we find that the same thing holds good of the other organs of our body, which often manifest very distinct capabilities without a corresponding anatomical distinction; such organs are the muscles, the larynx and the hand. Fine work, or that requiring technical ability, can no more be performed by an untrained hand, than a remarkable intellectual work can be performed by an unexercised or untrained brain, however large or well-formed it may be. A large brain may be compared to a large house with many rooms in which many persons *may* live. But many do not always live in such, whereas a small house may readily be filled with inhabitants.

On the other hand, there can be no doubt that the brain, the same as the sculptor's hand or the singer's larynx, may be improved and rendered more efficient by practice and use. All anatomists who have had frequent opportunities of dissecting human brains, agree in saying that the brains of learned men, of thinkers, poets and persons who have done much intellectual work, are denser, firmer, more convoluted and generally better developed in every way than those of ordinary persons. Nay, we are led to infer, from the important observations and measurements made by the famous physician and anthro-

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pologist Professor *Broca* on skulls in Paris cemeteries, that the influence of civilisation and of advancing culture alone has availed to cause a considerable increase in the perimeter of the skull, that is a growth of the brain, in the course of a few centuries; and also that the brains of persons belonging to the higher classes, who are more engaged in mental work, have as a rule a greater circumference than the brains of those belonging to the lower classes which are rather employed in manual labour. This law of growth of the brain, *pari passu* with increased intellectual activity, may be illustrated also in the animal world. According to the views of the famous American paleontologist Prof. *O. C. Marsh*, all the mammals of the tertiary age had comparatively small brains; and a gradual advance can be shewn from that time forward in the size as well as in the formation of the upper parts of the brain. The same law apparently holds good for reptiles and birds, from the mesozoic age down to the present time. The birds of the cretaceous period had brains that, compared with their bodies, were only one-third the size of those of their descendants now living, while the dinosauria of the jurassic age had crania which were far smaller in comparison to those of any reptiles now existing.

The observations of Prof. Broca fully agree with the fact known long since, that the skull and the brain are the only parts of the body which among people who lead an active intellectual life, continue to grow and to increase in mass *after* the rest of the body has left off growing, that is to say, right up to the fortieth year and even beyond.

The further observation of *Broca*, that the increase

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in the Parisian skulls was as a rule less in the brain as a whole than in the prosencephalon or forepart of the brain, is likewise borne out by earlier observations and measurements, which seem to shew that an increase of the sinciput and a simultaneous flattening of the occiput, or a throwing forward of the whole cranium with a simultaneous widening in the middle region, are the chief result of the fact of the brain having been developed by civilisation in course of time. Abbé Frère's fine collection of skulls belonging to all the centuries of our era, recently bequeathed to the Anthropological Museum of Paris, shews the different phases of this increasing development.

Broca's observations further agree to a nicety with the well-known experience according to which the forehead and its adjacent parts are, as a rule, less developed among the lower classes of the population than among the higher, and that there exists also a very marked difference in the circumference of the skull. The best proof of this is yielded by the common experience of hatters and cap-makers, that the educated classes on an average take larger hats and caps than do the uneducated, and also, as shewn by the observations of Prof. *Ranke*, that there is a marked difference in the average size of the brain between town and country, this difference being decidedly in favour of the inhabitants of the towns.

The largest known brains (excepting those enlarged by disease) have belonged to men who distinguished themselves in their lifetime by remarkable mental ability. While the average normal weight of the human brain is three pounds, the brain of *Cuvier*, the famous and ingenious naturalist, weighed nearly

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four. One of the largest known brains, according to the statement of Prof. *Broca*, who made exact measurement of the skull, belonged to our great poet *Schiller*. Next to his, if the statements relating to them are accurate, come the crania or brains of *Byron, Cromwell, Napoleon* I, etc. There is, nevertheless, no lack of reports on the brains of learned men, which were scarcely, if at all, larger than the average, and in which this relative deficiency may have been compensated by other advantages or by the industry and painstaking of their owners.

On the other hand, the weight of the brain of born idiots or imbeciles is as a rule far below the average. *Tiedemann* weighed the brains of three full-grown idiots, and found the weight in all three varying between one and two pounds. Dr. *Wilder* actually found that the brain of an idiotic woman, of 42 years of age, weighed only 330 grammes, and that of an idiot boy, 12 years of age, weighed only 260 gr. (10·6 oz. and 8·3 oz. avoirdupois.) Persons whose heads are less than sixteen inches in circumference, are invariably imbecile or weak-minded. "An exceptional smallness of head is always found in idiotcy." (Valentin.) The famous poet *Lenau* became insane and died in idiotcy; his brain, atrophied and ruined by disease, weighed only 2 pounds 8 oz. According to *Parchappe* (Comptes Rendus du 31 juillet, 1848) the gradual falling-off of reason in insanity is connected with the gradual decay of the brain. Drawing an average of 782 cases, he proved numerically that the comparative decrease of weight of the brain was proportionate to the intensity of the intellectual disturbance.

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Almost all great mountain ranges harbour in deep and damp valleys an unfortunate race of men, or rather semi-men, whose whole existence is rather brutish than human. They are repulsive, dirty, deformed beings, with very small or else excessively large heads, very largely developed jaws, badly shaped angular ape-like skulls, low small foreheads, protuberant abdomens, weak legs, bent carriage, very slight sensibility, and they are but rarely able to utter articulated sounds. None but alimentary and sexual appetites, and digestive and generative capacities are developed in them. Who on a mountain journey has not seen these *cretins*, standing stupid and indifferent with blank eyes in the road, or crouching at the doors of huts? The existence of this horrible anomaly in the human race results from a *defect of brain* which is mostly congenital. A commission appointed *ad hoc* by the Sardinian government issued some time since a very exact and detailed report on the cretins, in which it was stated that *in all cretins a faulty formation of the cranium and a defective or faulty development of the brain are to be found.* The same truth appears from Prof. *Virchow's* classical researches, which have shewn that Cretinism arises from a defective formation of the cranium and rests on a defective and faulty development of the brain, caused by an early ossification of the sutures of the brain, the development being therefore checked as a whole or in certain directions. Dr. *Knolz* observed in corroboration of this that cretins remain *children* even to their greatest age and keep doing everything that children are wont to do. "While I was studying the most important stages of the development of cretins,"

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said *Baillarger*, "I found that the general form of the body and of the limbs remained equal to that of very young children, and that *cretins* also preserved the tastes and desires of childhood." *Vrolik* of Amsterdam has published the results of a dissection of a nine-year-old cretin boy, who died on the Abendberg. (Verhandl. der koninglijken Akademie der Wetenschapen, 1854.) In this boy the mental development was so small that he had only learned to utter a few words. The cranium was small, oblique, the forehead narrow, the back of the head flattened; then again, the convolutions were few and imperfect, the sulci shallow, the brain asymmetric, with cerebrum and cerebellum imperfectly developed, the lateral ventricles expanded by water. In similar fashion the dissection of the body of an *imbecile* girl of 29 years of age — who had been in that state from her earliest childhood, who could neither read nor write, and who died of inflammation of the lungs — revealed a symmetrical atrophy (shrivelling) of both the posterior lobes of the cerebrum, so that they were *two inches* too short, and that the cerebellum projected an inch and a half beyond them.

The nature of the physical and corresponding mental differences that exist between the various human races, or species of mankind, are so well known that only a brief mention of these is requisite. Who has not seen either in reality or in a picture the narrow sloping skull, recalling that of the ape, of the African negro, and compared it in thought with the noble and broad cranial expansion of the Caucasian? And who does not know the innate mental inferiority of the black race, and how it is and

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must ever remain as an infant compared to the white? The brain of the negro is smaller, more brutal, less convoluted than that of the European, although it is not, as many think, the smallest in existence, seeing that Australians, Caribbeans, Bushmen, Hindoos, aborigines of Peru, etc. have considerably smaller crania. For while the average capacity of the cranium is 90 cubic inches in the white races, some Hottentot and negro crania have been found with a capacity of from 65 to 63, and some Hindoo crania fall as low as 46 cubic inches. This approaches very nearly to that of the highest cranial capacity of the *gorilla*, the largest of the anthropoid ages, which reaches 34 cubic inches. Among the Carribbeans and Hindoos the average weight of the brain barely exceeds two pounds. The ancient *Egyptians*, despite their high culture, had, as a rule, comparatively small heads, while the *Esquimaux*, with an average capacity of 86 cubic inches, approach the normal volume of the cultured European races; according to *Wallace* individual Esquimaux skulls have been found which are scarcely inferior to the largest European ones. The *Peruvians* and *Mexicans* — who became highly civilised and cultured long before any other American nation — had smaller brains than the rough barbarous American Indians, who were partly subdued by them. These facts — together with the circumstance that in some French caves belonging to the pre-historic Stone-Age (as in the Cro-Magnon cave, or in the "Caverne de l'homme mort") ancient pieces of skulls of the Caucasian type have been found, some of which exceed the present French skull in circumference and capacity — shew how little the mere proportion of cranial

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development is a reliable measure of the intellectual value of a brain or of its mental capacity, if size alone be considered without reference to other conditions. But if it be insufficient as a standard of *capacity* for work, it is still less to be taken as a safe guide to go by in determining the nature of the work itself, the performance of which does not depend on breeding and formation alone, but also on the important influence of the external conditions of life. Of what use, for instance, is his comparatively large brain to the Esquimaux — assuming the other conditions of form, structure and composition to correspond to its size — seeing that in his home of eternal ice and snow he is bereft of the very possibility of developing his talents? How could a similar privilege benefit the naked dweller of the tropics, who, on the one hand, is favoured, and on the other rendered indolent by the climate? What advantage could a handicraftsman, or a day-labourer, or a peasant, derive from his large and well-formed brain, being compelled to spend his life under the pressure of mechanical drudgery, far away from the intellectual impulses of civilisation? In what way could that pre-historic denizen of caves benefit by his intellectual ability, ample though it may have been, seeing that the circumstances in which he was placed, rendered their development impossible? Or, looking at the animal world, what is the good of his large brain and of his apparently corresponding intelligence, as it betrays itself in his large, thoughtful eyes, to the dolphin, seeing that the element in which he is compelled to live, and the clumsy form of his body, are a bar to all further development of his talents? And what is the use of the

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possession of a still larger brain to the elephant, since he lacks that differentiation of limbs and larynx, which has given man so great a supremacy over the animal world in his assuming upright position and originating articulate speech? All these examples, however, are mere exceptions which do not upset the rules that are based on countless facts, and their explanation probably depends on collateral circumstances as yet unknown to us.

Anatomy also bears out our contention about the necessary connection between the brain and the soul in the well-known experiments of vivisection performed by physiologists on the brains of living animals, — which experiments defy all contradiction. The most famous among these experiments are those of the French physiologist *Flourens*. Flourens experimented on animals, whose physical constitution enables them to endure considerable injuries to cranium and brain. He cut away the upper portions of the brain, layer by layer, one after another, and it is not saying too much to assert that as the layers disappeared one by one, the mental faculties of the animals diminished at the same time and eventually disappeared altogether. Thus Flourens succeeded in reducing fowls to a condition in which every mental function and every capacity of receiving sensational impressions or of performing any conscious action were completely annihilated, and yet physical life went on. The animals remained motionless at any spot in which they were placed, as though they were in a deep sleep; they responded to no external stimulus, and were kept alive by artificial feeding; they led, as it were, a mere vegetable existence. Thus

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they remained alive for months and years, and increased in weight and size of the body. Similar experiments have been successfully performed on higher animals, that is to say, on mammals. "If the cerebral hemispheres of a mammal are cut away piecemeal," says Valentin, "the mental activity descends all the deeper, the further the quantitative loss extends. As a rule, when the ventricles are reached, complete unconsciousness supervenes." What stronger proof of the connexion between mind and brain can there exist, than that of the anatomist's scalpel, cutting the mind away piece by piece?

This connection is fully as much corroborated by *physiological* examples — that is to say, by examples taken from life, — as it is by anatomical facts. By means of the nervous system, which radiates from the brain and which must in some measure be regarded as the controller of all organic functions, the brain superintends the whole organism and throws back upon the furthest points thereof the impressions it receives from without, whether they be of a physical or a psychical nature. This is known well enough, particularly in connection with the emotions. We grow pale with fear, we get red with anger or with shame. In joy the eyes glitter, the pulse beats more quickly in the excitement of gladness, fright brings on a sudden swoon, and vexation causes an efflux of gall. The mere thought of a nauseous thing will cause sudden vomiting; the sight of an appetising dish induces the rapid secretion of saliva in great quantity. A mother's milk is in a short time soaltered by emotion — as for instance by a sudden fright — that it may do the child the most serious injury.

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The fear of death turns the hair white from the same reasons which under other circumstances bring about this result far more slowly, simply as the consequence of increasing age. It is an interesting fact that intellectual work not only increases the desire for food, but also raises the temperature and the amount of carbonic acid given out from the body as a product of metabolic activity. Thus, as we mentioned before, the quantity of *phosphoric* compounds which appear in the urine as products of nervous waste, very much increases after violent mental excitement, emotion, etc., and grows much less when the activity of the brain is hemmed in. People of a *sanguine* temperament live quicker and less long than others, because the stronger mental excitation of the nervous system adds to metabolism and exhausts life more rapidly. On the other hand, *phlegmatic* persons live longer. Short-necked people are more lively and passionate, long-necked passive and quiet, because in the latter the blood-wave rushing to the brain is further from the heart, the centre and cause of its movement, than in the former. *Parry* succeeded in controlling cases of insanity by means of a compression of the carotid artery, and according to *Fleming's* experiments (Brit. Rev. April, 1855) this manipulation immediately causes sleep and feverish dreams in healthy persons. More accurately even than in men may the character be estimated in animals, such as horses and dogs, by the length of their necks. Great intellectual knowledge and power exercise, on their part, a strengthening and sustaining influence on the body, through the agency of the nervous system, and *Alibert* mentions as a frequent observation of physicians that a dis-

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proportionately large number of old men are found among the learned. Conversely, the most varied physical conditions are directly reflected in the *psyche*. What an immense influence does not the secretion of gall exercise on mental disposition! Degeneration of the ovaries causes satyriasis and nymphomania; any affection of the sexual organs often causes an uncontrollable desire to murder or to commit other crimes. How often is hypocrisy in religion connected with excess of sensual desires, and so on!

Finally, pathology, the science of disease, abounds in the most striking facts, and teaches us that no serious material or functional derangement of the parts of the brain concerned in the function of thought can occur, without corresponding injuries to the psyche. Whenever such a case does happen, it is only when the lesion is entirely confined to *one* cerebral hemisphere, and the other hemisphere assumes, as it were, a vicarious trust.*) The stories about men who remained uninjured in their reason when *both sides of the brain were destroyed* or diseased, are mere fables. Inflammation of the brain brings on delusions and insanity, effusion of blood on the brain causes stupefaction and complete unconsciousness, pressure on the

*) This vicarious action of one hemisphere in lieu of the other does not always take place. Dr. Meissner (Wagner's Archiv der Heilkunde, 1861, vol. I) describes a case of dropsy in one hemisphere, originating in the sixth month of life. The patient lived to be 71½ years old, his body was powerfully developed, but his mind remained backward, until complete insanity supervened, and the man was good for no other avocation but that of cutting wood. Every four weeks he had an attack of epilepsy. The weight of the brain was only 27 ounces. The ventricles on the healthy side were also slightly expanded.

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brain occasions mental weakness, idiotcy, etc. Who has not beheld the painful sight of a child suffering from water on the brain? Mad people, and people who are mentally diseased, always have diseased brains, sometimes from direct brain-lesion, sometimes as a reflex from some other diseased bodily organ, and by far the greater number of physicians and medical psychologists now hold that a physical injury, and more especially one of the brain, lies at the root of all psychical or mental diseases, or is connected with them, even though the latter may *not in all cases* be perceptible to our senses, owing to the imperfection of our diagnostic appliances. And even those who do not wholly agree in this view are compelled to admit at least that no mental disease can be imagined without a serious *functional* disorder. But such functional disorders again cannot be conceived without material disorganisation, whether it be permanent, transitive or not even noticeable; and if they should continue long they lead to anatomical changes in the substance of the brain. *Gayet* (Arch. de Physiol. 1875, pp. 341—351) relates a case in which a man of 28 years of age, merely from a sudden fright, became mentally diseased and died after several months. The post mortem shewed an enormous reddening and softening of different important parts of the brain. Experiments on animals (for instance on rabbits), whose crania have been opened, have shewn that a sudden fright *at once* causes a contraction and whitening of the blood-vessels of the pia mater, and a momentary contraction of the whole brain. (Compare Deutsches Archiv für klin. Medicin, vol. XIV, Parts 5 and 6.) According to the psychiatrist

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Dr. *Wille* (Versuch über Seelenstörungen, 1863) mental disorder consists only in a nervous disease of the brain, and it is a settled law that "morbid changes in the grey matter of the brain are always connected with morbid phenomena of psychical life, or in other words, they cause a morbid condition of the mind." Besides, even mere functional or nutritive disorders of the nervous elements by anemia or plethora, by mixture of blood, by drunkenness, narcotism, delirium, bad food or bad air, etc. etc., bring on mental disease or disturbance, without any important anatomical change in the brain becoming perceptible. These anatomical changes are often, as stated heretofore, so very slight that they can only be shewn by the most minute microscopical research. Thus, Prof. *Heschl* (Oesterr. Zeitschr. für prakt. Heilkunde, 1862) found *ossified nerve-cells in the grey layer of the brain* of a hypochondriac, and Dr. *Leidesdorf* twice observed cases of rapid delirium combined with raving madness, which brought the patients quickly from previous health to the grave. In both cases microscopic investigation revealed a *very considerable increase of the nucleus in the ganglionic cells of the grey matter,* while there was nothing else essentially diseased in the brains, save a serous moistening throughout them and their envelopes.

A fatty pigmentary degeneration and softening of the same elements brings on what is called *dementia paralytica,* or idiotcy, combined with phenomena of lesion generally, and this is followed by a more complete destruction of the mind than is caused by any other brain-disease. But even without perceptible anatomical changes of the ganglionic cells

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of the grey matter, a mere suspension of their nourishment by injury to the blood supply or by the hardening of the cellular tissues around them suffices to bring about the most serious mental disorders and even incurable idiotcy.

No one who thinks scientifically and values facts will hold that the well-known psychiatrist *Griesinger* was wrong, when he said, in his lecture at the opening of the school of clinical psychiatry at Zurich (1863), that mental diseases were nothing more than "symptoms of disorders of the brain and the nerves."

We should consider also the well-known and unfortunately too frequent *transmission* of mental diseases, a result that can only accrue from a changed condition of the germinal matter, and the transmission of this material condition to the brain and nervous system of the being originating therefrom.

Physical lesions or injuries of the brain often cause remarkable psychical effects. It has been credibly reported that in St. Thomas's Hospital, London, a man badly injured on the head spoke in a foreign language. It was his native Welsh, which he had formerly spoken at home, but had forgotten in the course of a thirty years stay in London. Owing to the same cause he had forgotten English entirely. The same thing happened to a German American, Dr. Solger, who, when he died, held the position of secretary to the Treasury of the United States. He had received a serious injury to the skull and brain by a fall from his horse. From that moment forward he entirely forgot his English and French (he had married a Frenchwoman), and until his death, which took place shortly after the fall, he spoke nothing

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but German. A Parisian painter, Victor X., fell from the balcony of a house and suffered a concussion of the brain. He at once forgot the names of his friends and of the members of his family, and only remembered some letters out of their names. On Sept. 13, 1848, a blaster, named *Phineas Gage*, residing at Cavendish in America, had an iron rod driven through his head by a premature explosion while he was tamping. The rod destroyed a considerable portion of the left cerebral hemisphere. After a long illness he recovered, but his mind and character were so changed that his friends said of him that he was Gage no more. The balance between his mental capacities and his animal propensities was destroyed. He left his employment and, having led the life of a vagrant, died $12^1/_2$ years after the injury; his skull with the iron rod may be seen in the anatomical museum of Harvard University. (See Proceedings of the Mass. Med. Soc. 1863, vol. II, N. 3, p. 330.)

The well-known fact that mad delirious persons sometimes recover consciousness before death and partly regain the use of their reason, is often brought forward in support of a spiritualistic conception of the relationship between brain and mind. It should, on the contrary, be understood in such cases, that the reason of this remarkable phenomenon is the fact that the brain, having by long illness and general exhaustion been brought to the verge of death, is *relieved* from the troublesome and morbid influences of the body, and this fact, if looked at in that light, is a striking confirmation of our position. But even physiologically this remarkable phenomenon has been explained by the assumption that in such cases only

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one hemisphere of the brain had been diseased, while the other and healthy one has gradually been affected, in sympathy with it, in the same way as for instance in a stoppage of circulation in one finger the corresponding finger of the other hand will sometimes begin to ache. Now if death should result in consequence of the brain-lesion, the hemisphere that was first affected and most diseased naturally dies first, while the sympathetically affected hemisphere is freed from the pressure that weighs on it, and the patient recovers consciousness until the second hemisphere also dies.

Quite apart from all this, the pathological facts supporting the identity or necessary connection between brain and mind are so numerous that whole books or libraries might be filled with them, and to a great extent they are accessible to daily experience or to the simplest observation. In point of fact, the weight of this evidence has never been denied by thinking men. "If the blood," says *Frederick the Great* in a letter to Voltaire, written in the year 1775, "circulates too rapidly in the brain, as in the case of persons in a state of drunkenness or in the paroxysm of fever, the ideas become confused and are turned topsy-turvy; if there is a slight obstruction in the nerves of the brain, insanity results; if a drop of water passes into the cranium, the loss of memory supervenes; if a drop of blood exudes from the vessels on to the brain and the nerves of reason, we encounter at once the cause of apoplexy" etc.

If the mind, as spiritualists contend, be a thing independent or self-existent, and controlling or utilising matter, why is it so little able to defend itself

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against and repel these attacks? Why does it yield or succumb to a blow on the head, the commingling of a few drops of blood with the substance of the brain, a sunstroke, a few inhalations of chloroform, a few glasses of wine, or a few drops of opium, prussic acid or other poison?

But enough of facts! All anthropology, the whole science of man is one continued proof of the inseparability of the ideas of brain and mind. Let philosophical psychologists talk as they may about the autonomy of the human mind and its independence of its material substratum, their utterances appear as idle clatter in the light of facts. "I do the spiritualists no injustice," says *J. C. Fischer* (Die Freiheit des menschlichen Willens, Leipzig, 1871), "when I say that their deductions are one and all most pitiable delusions; they only speak to shew that they are too impotent to bring forward a single positive proof. They will remain impotent so long as they continue their speculative labour of Sisyphus, instead of using the positive experimental method of natural science" etc.

It was thought that a weighty argument had been brought forward against the materialistic or monistic conception of the relation between brain and mind by shewing the material simplicity of the organ of thought. The brain, it was said, is mainly a soft, homogeneous mass, distinguished neither by a complicated structure and delicate formation, nor by a special chemical composition. How is it possible, then, that this simple, homogeneous material can be the fundamental cause of so infinitely delicate and complicated a machinery as is represented to us in the

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human or animal mind? Complicated forces and activities imply complicated materials or combinations of matter. Clearly the connection is rather a loose and accidental, than a necessary one; the mind exists by itself, independent of earthly matter, and is but accidentally or for a brief space of time connected with the material tissue which we call brain.

This whole objection, weighty as it may appear in the eyes of uninstructed persons, rests altogether on false premisses or suppositions. The brain is not a simple organ, but is in the highest degree composite, rich in structure and delicately formed, to such an extent, too, that in the whole organised world there is nothing which we can in this respect compare with it. "To the superficial observer," says H. Tuttle, "the brain appears to be only a homogeneous mass; on closer investigation its structure is seen to be one of the most delicate organisation and of the highest perfection."

As regards first of all this structure in its broad outlines, a mere cursory inspection of the brain brings before our eyes a large number of wonderfully shaped and intricate external forms, the physiological significance of which is more or less doubtful, and on its surface we behold numerous irregular, deep convolutions, already described heretofore, among which the two principal components of the brain, the grey and the white, meet each other at the greatest possible number of points, and the exact activity, form and quantity of which, as we have seen, stands in a very definite relationship to mental and intellectual activity. The variety and curious nomenclature of these individual parts of the brain shew with what

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various and peculiar forms we have to deal here. "In the brain," says Prof. *Huschke* in his famous work, (Schädel, Hirn und Seele des Menschen), "we find mountains and valleys, bridges and water-courses, beams and arches, pins and hooks, claws and ramshorns, trees and sheaves, harps and trumpets, etc. No one knows the significance of these wonderful shapes." If, in this respect, we compare the brain with other organs of our body, we find that the latter are so far beneath the former that it becomes impossible to speak of an analogy between them. We arrive at a similar result in comparing their relative blood supply. As we have already mentioned, the brain among all the organs of the body is the one to which by far the largest quantity of blood goes from the heart, and in which therefore the metabolism proceeds more swiftly and more actively than anywhere else. It has, in fact, been shewn by experiment that among all the organs of the body the brain has the highest temperature, and that about one-third of the entire process of oxidation of the body is needed in the brain to maintain the fire that burns unceasingly in it during waking hours. Corresponding to this, the anatomical activity and arrangement of the blood-vessels and the large blood sinuses within the skull are such as are found in no other part of the body, and the blood circulation within the brain is so great that a cross-section of the collective blood-vessels of the neck is three times as great in extent as a cross-section of the large blood-vessels of the thigh, although the latter is far more massive and includes moreover the whole of the blood-vessels of the leg. Among the individual parts of the brain the grey

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substance, or the peculiar seat of mental processes, is comparatively the richest in blood, for these processes require the most rapid metabolism and the most intense oxidation. Hence, every disturbance in this necessary interchange between the blood and the substance of the brain is at once attended with a disturbance of consciousness or of other mental activities.

Problems far greater, and much more difficult to solve, than those of the general anatomy of the brain, make their appearance when we come to subject it to a closer microscopical examination. Yet this much we know above everything else, that the brain is no simple homogeneous mass, as persons imperfectly instructed imagine, but that, like the nervous system generally, it consists partly of an almost innumerable array of very delicate *primitive or nerve-fibres*, and partly of an equally inumerable host of *nerve-cells* or *ganglionic centres*. The former are so minute that the aggregate thickness of six hundred of them does not exceed the twenty-fourth part of an inch, and the total number of them contained in the body has been computed at from 600 to 1000 millions; they are exceedingly fine and exceedingly soft transparent tubes, containing an oily, coagulable substance called *nerve-marrow*, which in its turn consists of two concentric and chemically distinct layers, one surrounding the other; the middle one is the *axis-cylinder*, and the envelope of nervous substance is the *marrow tube* (white substance of Schwann). The *nerve-cells*, *nervous* or *ganglionic centres*, being the second histological element or tissue of the nervous mass, are found in vast quantity, more especially

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in the grey matter of the brain and spinal cord (the ganglionic cells of the grey external layer of the brain alone being estimated at from 500 to 1000 millions), and having received the impressions coming to them from the external world by the fibres, work upon these and change them into reflective or volitional acts. These cells exhibit many peculiarities and differences of build, and are disposed in no less than from five to seven distinct layers in the grey envelope of the brain of which they form the chief part; each layer in its turn exhibiting peculiarly shaped cells of different sizes. The researches of Prof. *W. Betz* of *Kieff* (Centr.-Blatt der medic. Wissenschaften 1881, N. 11 to 13) have shewn that there is a greater diversity in the grouping of the third or pyramidal cell-layer than elsewhere. The same scientist thinks that he has discovered that each small portion of the surface of the human brain, whether formally marked off or not, is distinguished by a peculiarity of build, which view agrees admirably with the well-known investigations of modern scientists (Ferrier, Hitzig, Frisch, Nodnagel, etc.) on the so-called "centres of motion" to be found in the surface of the brain.

As regards the relationship of the ganglionic centres to the nerve or primitive fibres, the former are connected with the latter by each nerve ending in a cell, and from each cell several fibres — at least three — are given off, which either go over into the nervous system, or unite the several cells with each other. The nerves or nerve-fibres may very suitably be compared with the wires of an electric telegraph, which convey news in both directions alike, while

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the ganglionic centres may be equally well compared with the electric apparatus itself, which receives the impulses coming to it from without and gives them forth again, or forwards, as it were, its own telegrams.

It is to these cells or ganglia that we must look for the peculiar seat or anatomical element of our mental and intellectual activity, and it can scarcely be doubted that the variety that exists in their internal and external form and arrangement stands in a definite relation to the multiplicity of these processes. To all appearance there are not only special cells or nervous centres for the performance of the actions of sensation, movement, nutrition, and reflection, like a parallel to what we know already of the nerves, but there are also such centres for the different forms of higher psychical activity, such as reason, imagination, reflection, sense of number, of space, of music, of beauty, etc. etc., albeit anatomy has hitherto been unable to discover them, owing to the clumsiness and imperfection of its appliances. If we consider the enormous number — *i. e.* from 500,000,000 to 1,000,000,000 — of nerve-cells that are present in the grey layer of the human brain, and from which issue *at least five* or *ten* times as many nerves, uniting them with each other and with the outer world, it must be admitted that these numbers offer even to the boldest imagination a more than sufficient perspective as an anatomical basis of all conceivable psychical processes or nervous actions. If the aggregate number of conceptions which are, or may be, contained within the brain, be set down at 200,000 — an estimate very much above the mark, seeing that our most polished

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language has *at most* 15,000 words, that there are very few wordless conceptions, and that, even supposing that each conception might be couched in four or five different forms, we should make up but a total of 100,000 *at the most* — it becomes plain that each conception would have from 2500 to 5000 cells and from 10,000 to 50,000 fibres corresponding to it, assuming, of course, that those conceptions be uniformly distributed over the whole surface of the two cerebral hemispheres. Now inasmuch as this is certainty not the case, it cannot be doubted that, however rich our conceptual life may be, the number of the nervous elements representing it must yet greatly exceed its necessities, and that the brain possesses an enormous abundance of unoccupied and unused spots for the utilisation of which there is no prospect whatever. At all events, the anatomical structure and disposition of the brain would admit of a very much richer conceptual life than is as yet possessed by the human mind, and this being so, the enthusiastic partisan of progress and evolution sees opened up to him the prospect of the fulfilment of his boldest hopes for the future achievements of his race.

Taking all these things into consideration, and remembering that the chemical composition of the brain is not so simple as it was formerly thought to be, but that very peculiarly constituted bodies, such as cerebrine and lecithine, are present in it, and that there are marked chemical differences between different parts of the brain, it must be admitted that the materiality of the brain, whether regarded under its morphological, histological or chemical aspects, is by no means fitted to serve as an essential objection to

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the materialistic or monistic view of the relation between brain and mind. Assuming even the brain were not that wonderfully organised structure that we have learned that it is, and that the simplicity of the brain-materiality did not contrast with its achievements, we should yet have one thought left to reassure us. Countless examples make it plain that Nature is able to achieve the greatest and the most wonderful results by the simplest and least pretentious means, according to the way in which she arranges the innermost conditions and motions of infinitely small and delicate materials. Why, even man is able to form out of coarse metal or bits of wood, by the aid of very imperfect tools, instruments that play many tunes, timepieces that tell the hour, machines that weave, knit, sew, write, run, and outstrip the speed of the swiftest animals. In this we see nothing marvellous. But just put a savage, or a man who has never heard of mechanics, in our place; would he not imagine that these machines were living things, moving by their own volition? and would not one of the imbecile aborigines of New-Holland have as good a right, as Virchow remarks, to maintain that these machines do not act on mechanical principles as the partisans of the spiritualistic theory have to maintain that the mind cannot be explained by material motions? Perhaps the simile does not run on all fours and may be thought to prove nothing; perhaps it may only point out to us the way of understanding that possibly the mind may after all be but a product of material combination. "Nature," says Prof. *Pflüger*, "works with infinitely small atoms, and therefore can form a mechanical contrivance in a very small space

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which can play a million of the most varied tunes, which are exactly calculated for and fitted to a million wants that may possibly arise in the course of a man's life."

In connection with this we should also consider a marvellous force that surpasses all imagination, viz. that of the animal or human seed, mentioned in an earlier chapter, which, by a single organised cell of such minuteness that it can only be seen through a microscope, is able to control to a certain extent the whole of the physical and psychical life of that which has been begotten, by the aid of the forces or tendencies of motion communicated to it by the begetter. And what this one cell can do, why should not thousands of millions of other similar or cognate forms be able to do it, though in a different way, being connected together in the most wondrous union and composition? "This fact," forcibly remarks Prof. *Häckel* in his Generelle Morphologie der Organismen (1866), "gives us an idea of the infinite fineness of organised matter and inconceivable complication of molecular movements in the same state, which neither the power of observation of our senses nor the power of thought of our reason fully enables us to understand."*)

However, for the purpose of this enquiry it is really quite immaterial whether and in whatever way a conception of all this be possible, or how mental phenomena arise from material combinations or from the activities of the brain. It is quite sufficient to

*) For further particulars on this subject refer to the Author's "Zur Philosophie der Zeugung," in "Licht und Leben," Leipzig, 1882.

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have proved by facts the necessary, indissoluble and normal connection between the brain and the mind.

The spiritualistic philosophers and psychologists, who regard the mind as an entity, independent, self-contained, and but temporarily united to the body, have sought to get over these facts in various ways, but, as it appears to us, invariably with an unfortunate result. They fall into contradiction either with themselves, or with the facts, or they seek to veil the clearness of the question in a sort of half mist, or they invent theories and delusions which call for compassion rather than refutation. They find themselves utterly unable to shew how it is imaginable or possible that a thing purely spiritual or immaterial, such as they represent the mind to be, can enter into union with matter, can act upon it, or be acted upon by it. Absolute antitheses can never be united, whereas we find brain and mind, body and spirit, always in absolute and actual union. "No philosophy," says *David Strauss* (Alter und Neuer Glaube), "has ever explained nor will ever explain how it is possible that from a thing with dimensions and without thought like the human body impressions could ever pass to a non-thinking thing without dimensions, such as the mind is supposed to be; how impressions can be returned from the latter to the former, and how above all there can be any kind of communion between the two."

As a last resource, spiritualism has hit upon the so-called *piano-theory*, according to which the mind stands in the same relation to the brain as a player does to his instrument. There is no escape through this loophole either. Who has ever heard of a piano that

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grows with its player, that lives with him, sleeps with him, falls off and becomes ill with him, or by being out of tune makes him incapable of reflection, or continues to play confused melodies after the player has gone away, or which can only maintain its strength by constant change of material and a regular alternation of activity and rest? Such a piano would indeed be a remarkably strange thing, apart from many other difficulties which militate against that theory. To carry this monstrous comparison to its logical ends, we must admit the same or a similar proposition for every other organ of the body, and assign a nerve-soul to the nerves, a muscle-soul to the muscles, a liver-soul to the liver, etc., all rank absurdities, into which it is not worth while to enter any further. The word "mind" is nothing more than a collective word and a comprehensive expression for the whole of the activities of the brain and its several parts or organs, just as the word respiration or breathing is a collective word for the activity of the breathing organs, or the word digestion is a collective word for the activity of the digesting organ.

No doubt, in the case of the brain, that highest and fairest blossom of all terrestrial organisation, something more is meant than in the case of the organs of breathing or digestion; we are dealing with the highest achievement of material combinations, we might say with the intellectualisation of matter and with the life and destiny of all that is great and noble among man's achievements on earth. Everything comes *from* it, and everything proceeds *out* of it. It receives everything, and gives back everything. Who that has thrown but a single glance at the powers

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and tendencies of this most wonderful of all organs, of which unfortunately so many men scarcely know the proper use, can refuse to endorse what *Huschke* says: "In the brain lies the temple of the highest that is of interest to us. Yea, the destiny of the whole human race is indissolubly bound up in the 65 or 70 cubic inches of brain-mass, and the story of mankind is recorded therein, as in a vast book, full of hieroglyphic symbols."*)

*) A far more detailed account of the anatomico-physiological relations of the brain and of its intellectual phenomena in the state of health and disease than can be given here, as well as a searching criticism of the "piano-theory," and a division between the conceptions of "mind" and "spirit" on an anatomical basis, will be found in the Author's work, "Physiologische Bilder," vol. II, pp. 3 *et seq.*

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THOUGHT.

Thought is a motion of matter.

Moleschott.

As color is to the vibrations of light, as sound is to the vibrations of elastic fluids, so is thought related to the neuro-electrical vibrations of the brain-fibres.

Huschke.

Since man, a material being, actually thinks, matter also enjoys the power of thinking.

Holbach.

A reason for writing this chapter is afforded us by the well-known and well-abused phrase of *Karl Vogt:* "Thoughts stand in the same relation to the brain, as bile does to the liver or urine to the kidneys"; which idea had, for that matter, been uttered long before Vogt and in exactly similar fashion by the French physician and philosopher *Cabanis* (1757 to 1808). "The brain," said he, "is destined for thought, as the stomach is for digestion, or the liver for secreting the bile from the blood," etc.

Without in the least wishing to join in the general cry of condemnation which this expression brought on its author (although he had introduced it with the words, "to express myself somewhat coarsely"), we yet cannot refrain from finding the comparison unsuitable and badly chosen. Even in

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looking at the matter without the least prejudice, we cannot possibly find any analogy or true resemblance between the bilious and renal secretions and the process by which thought is produced in the brain. Urine and bile are tangible, ponderable, visible substances, and are moreover excreta or waste products discharged from the body; thought or thinking, on the other hand, is no excretion, but an activity or motion of the substances and material compounds grouped together in a definite manner in the brain. The secret of thinking does not lie in the brain materials as such, but in the special form of their combination and in their co-operation towards *one* object under the perfectly definite anatomico-physiological conditions which were described in a former chapter. Thinking can and must be regarded as a special mode of general natural motion, which is as characteristic of the substance of the central nervous elements as the motion of contraction is of the muscle-substance, or the motion of light is of the universal ether. Therefore understanding or thought is not a substance; it is material only in this sense that it is the manifestation of a material substratum, just as heat, light and electricity are inseparable from their substrata. *Thinking and extension* are therefore only to be regarded as two sides or phenomenal manifestations of one and the same single existence.

That thinking is and must be a mode of motion is not merely a postulate of logic, but a proposition which has of late been demonstrated *experimentally*. It has been shown by minute observations of the rapidity of the transmission of nervous impulses that this rapidity, compared with other modes of motion,

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is very small, and that the same thing is true of the psychical processes or thought-motions going on in the brain, which only become possible by the help of the communicating nerve-fibres which join the ganglionic cells of the grey layer together. Very ingenious experiments have proved that the swiftest thought that we are able to evolve *occupies at least the eighth or tenth part of a second*, and that this spell of time increases in proportion as absence of mind, inattention, weariness, or indolent or disordered mental action, affect the rapidity of reception or of reaction. Thence follows this essential conclusion, that, as Prof. *A. Herzen* says in an excellent article (Kosmos, 1879—80, pp. 207 *et seq.*), the psychical act or thought act takes place in an extended resistant and composite substratum, wherefore such an act is nothing more than a mode of motion, which on its part again must, like every metabolic change in the body, be attended with the production of a definite amount of heat. In point of fact, physiological experiment has proved that the temperature of the nerve rises when it enters into activity. In the same way Prof. *Schiff* has proved, by very ingenious experiments, that the arrival of a sensational impression in the brain causes an immediate rise of temperature. All this goes to shew that psychical activity is nothing more than a motion going on between the cells of the grey matter, caused by an external impression. For there is no such thing as a thought whose subject does not bear on the senses. All intellectual activity proceeds in final resort from sensation and from the reaction or response of him who experiences the sensation towards the outer world. There are

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no ideas unconnected with the impressions that are received or have been received by the senses; and in the joining together of these ideas by means of the inter-communicating nerve-fibres lies the essence of intellectual activity. The words *mind, spirit, thought, sensibility, volition, life,* designate no entities and no things real, but only properties, capacities, actions of the living substance, or results of entities, which are based upon the material form of existence. The great blunder of the philosophic schools was that they took the words or signs which in reality have but a conventional meaning as entities, and as things real: by doing so they created an incurable confusion in a state of things that is very simple in itself. This confusion is maintained and increased by the utterly false conception of matter, dealt with in a former chapter, which they have put forward, and which prevents them from doing justice to it. What earthly ground have spiritualists to stand on in contending, as they do, that matter cannot think? None, save that false one, which has to some extent become our second nature, owing to our spiritualistic training. Is it not, on the contrary, a patent fact obvious to all but the wilfully blind, *that matter does think? De la Mettrie* made merry over this narrowness of the spiritualists, in saying: "When people ask whether matter can think, it is as though they asked whether matter can strike the hours!" Matter indeed *as such* thinks as little as it strikes the hours; but it does both, when it is brought into such conditions that thinking or hour-striking results as a natural action or performance.

Voltaire compares the mind with the song of the

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nightingale, which rings as long as the little organic machine that emits it lives and works, but which ceases with the extinction of that activity. The same simile holds good of any machine made by man. When a steam-engine performs work, or when a clock shews the hours, these are results of their activity, just as thought is the result of the complex machinery of that material tissue which we call brain. But the be-all and end-all of the steam-engine does not consist in producing steam, nor is it the chief object of the watch to evolve heat by its motion; in the same way the essential part of the brain-mechanism does not consist in its producing heat or that minute quantity of fluid which is present in the ventricles of the brain. It does not produce matter, like the liver or the kidneys, but is an activity, which appears the highest blossom and fruit of all terrestrial organisation.

It having once been shewn that thought is indissolubly conjoined with definite material motions, it will be sufficient to throw a mere glance on the great and invariable law of the maintenance or conservation of energy, in order to convince every person endowed with a clear mind that thought or psychical activity is everywhere but a form or a particular manifestation of that mighty, universal and simple natural force, which sustains the eternal cycle of energies, revealing itself now as mechanical, now as electrical, now as mental force. It is of no great consequence whether the metabolism maintained by nutrition and constantly going on in our bodies, lends to the woodcutter or the pedestrian the force he uses in his muscles, or to the scientist, the thinker, or the poet, the force which creates thoughts in his

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brain; the form or the effect only differs in accordance with the variations in the organs concerned.

Recent investigations have shewn that a force, which had hitherto been noticed and observed clearly in the inorganic world alone, plays so important a part in the physiological processes of the nervous system, that nervous energy and electricity may be looked upon as the same thing. Each nerve must be regarded as the source of an electric current, generated therein by the motion of countless electromotive molecules that make up the nerve. The nerves therefore are not merely, as was formerly thought, *conductors*, but actual generators of electricity; they generate it by metabolic changes occurring in their interior, that is in the nerve-marrow and axis-cylinder. Very subtle experiments have proved that the electricity generated in the nerve subsides or vanishes completely when the nerve is excited, or when it performs a physiological function, which is the same thing; while on the other hand it accumulates electro-motive force during rest and inactivity. This proves conclusively that nerve-force, nerve-activity, and nerve-action, are synonymous with transmuted electricity, and that the nerve is only one of those countless appliances to be found in Nature, which are destined to change static or latent into active or dynamic force. This change is effected, in the first instance, by electricity being set free, as a result of the chemical processes that take place in its interior, and next by this free electricity being changed into nerve-activity. But since this activity consists chiefly in the phenomena of sensation and volition, and since — as indeed no proficient psychologist doubts at the

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present day — all psychical activity is developed and built up successively by repeated and gradually intensified sensations or impressions from without transmitted by the nerves, we actually stand on the very threshold of a knowledge which will no longer allow the evolution of all psychical action from Nature's general store of power and its subordination under the great law of the conservation of energy to appear in the least doubtful. Neither can it be doubted that this is possible and conceivable only by the mediation of the material substrata or organs, specially fitted therefor, as the brain more particularly is for thinking, that is to say, for the reciprocal concatenation of the conceptions arising from external impressions by means of the fibres or conductive organs connecting the cells of the grey layer of the brain with one another.*)

In the foregoing we have expressed the perfectly accurate fundamental thought which lies at the root of Vogt's comparison, however inappropriately such a comparison may have been chosen. As there is no bile without liver and no urine without kidneys, so there is no thought without brain; mental activity is a function of brain-substance. This truth is simple, clear, and borne out by countless facts. The so-called *acephali* or headless beings are children who are born into the world with a mere rudimentary brain-structure *i. e.* with one but partially developed. These

*) These brief hints on the life of the nerves, and especially on the highly interesting question of nerve-electricity, are severally dealt with at somewhat greater length and in a generally intelligible form in the Author's "Physiologische Bilder," vol. II (Leipzig, 1875), pp. 229 *et seq.*

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unhappy creatures, which offer the most unfavorable argument possible for the alleged theory of design in Nature, are incapable of any human development and die early; for they lack the essential organ of human existence and thought. The *microcephali*, or small-headed children, are closely related to these. They have imperfectly developed brains, and though they can live and grow, they are in their whole being more like animals than men, and in mental capacity stand far *below* the grade of an intelligent animal. "Nothing is more certain," said even the spiritualistically-minded *Lotze*," than that the physical condition of bodily elements may formulate a number of activities on which the existence and form of our mental condition *of necessity* depend."

When matter vanishes, thought vanishes too.

"Why" exclaims *Hamlet* in the famous churchyard scene, "may not that be the skull of a lawyer? "Where be his quiddities now, his quillets, his cases, "his tenures, and his tricks? Why does he suffer "this rude knave now to knock him about the sconce "with a dirty shovel, and will not tell him of his "action of battery? .... Where be your gibes now, "poor Yorick? your gambols? your songs? your flashes "of merriment that were wont to set the table on a "roar? Not one now?"

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CONSCIOUSNESS.

Capacity of consciousness muts lie dormant in the existence of the atoms; otherwise our brain, which is a group of atoms, could not possess consciousness.

Meynert.

The attempt to construct an immaterial being or an unchangeable Ego out of the phenomena of consciousness and self-consciousness must be considered as having failed just as much as every other similar attempt.

A. Mayer.

Sensation and consciousness differ from one another but quantitatively and not qualitatively.

H. Kühne.

If, as has been shewn in the foregoing chapter, our whole mental life has been built up gradually from repeated sensations, caused by impressions from without, the same thing must be true of consciousness, and especially of self-consciousness: for this is essentially nothing more than the sum total of our sensations, or a cumulation and aggregation of pictures imprinted on the memory. Therefore, the lower we go down the ladder of organisms, the less clear and the more confused does consciousness become, until, having finally arrived at the simplest protoplasmic animals, we see all reactions to external stimuli merged in almost imperceptible movements, and no longer able to separate these movements,

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caused by pleasure or pain, from the elementary properties of organised matter. (O. Schmidt.) Only when we get to the higher animals and to man does consciousness become a factor of such importance that a special study of it as a separate intellectual capacity becomes possible. This, however does not take place suddenly, but very slowly and gradually on the strength of the improved organisation of the brain and nervous system, and of an increasing abundance of impressions and of the ideas that are formed by them. In this respect the new-born human child stands scarcely higher than the lowest animal. It requires long use and experience before it can localise its individual sensations and learn to draw a line between them. When it has succeeded in doing this, it gradually develops self-consciousness and recognises its own Ego as distinct from other Egos and from the Non-Ego. Yet this can only be performed to perfection when thought has reached a certain stage of development, and when long experience supplies sufficient material to it. But since this material is subject to continuous changes, the consciousness must also change; it can never be the same in two separate moments. And this is actually the case; only the change proceeds under normal circumstances in such a gradual and imperceptible manner that we only become aware of it when we survey large portions of our life at once, whereas in the case of diseases of the brain and the nerves the change may go on very rapidly. The moral personality behaves just the same as does the physical. Both change unceasingly, but only after long periods can we recognise the change with clearness. Do we not, in po int of fact

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in afterlife, find it often quite impossible to place ourselves back into the opinions, views and mental tendencies of earlier years, or to believe that at one time our idiosyncrasy was such or such? Of our earliest childhood we, as a rule, know either nothing at all, or we know it but from hearsay. Therefore, to be accurate, we should not speak of *being* conscious, but only of *becoming* conscious, as it were, in an incessantly, changing, now increasing, now decreasing proportion.

Besides, this one thing can never be sufficiently emphasised in opposition to all theistical and pantheistical conceptions, that consciousness *can only originate in the individual,* for the individual only can have an opposite or a Non-Ego from whom he differs by his consciousness, whereas consciousness can never belong to the Infinite, which has no opposite and can receive no impressions from without.

The spiritualistic psychologists or spirit-hunters, who see ghosts everywhere where there are none, and who try to obfuscate the simplest and most lucid things by wrapping them in a cloud of words, have bandied about the word consciousness even more than they have that of mind, seeking, as they do, to represent it as a metaphysical, immaterial, single and simple, inextensible, indivisible, and ever unchangeable being, as the last and chief resort of all mental activities, something like the manager of a play, who, standing behind the scenes, superintends the play of the phenomenal world of sensations caused by impressions. But of consciousness the same remark hold good as of the mind; it is not that single, simple, inextensible and indivisible being as which the philo-

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sophers are wont to represent it, but on the contrary a very complicated composite thing, dependent on a whole range of diverse brain and nerve particles separated in space. Far from being single and simple, inextensible or indivisible, consciousness is composite, extensible, divisible and changing, and in proof of this, countless experiments of practical mental science can be adduced. It is, as *Bastian* remarks, one of the worst of errors to suppose that consciousness includes the whole mental being, for experimentally it has been found that many mental processes go on *without* consciousness. In fact many phenomena prove that consciousness may for a time disappear or be injured, without psychical life being extinguished at the same time. On the other hand, consciousness may in many instances of daily life be perfectly preserved and remain uninjured, and yet keep outside the range of numerous stimuli and purposive movements. For instance, if we read aloud, as Huxley has pointed out (Principles of Physiology, Lecture 11), a number of delicate muscular movements are going on of which the reader is wholly unconscious, such as the movements of the hand, the eyes, the lips, the tongue, the laryngeal and respiratory muscles, etc., while the whole attention is directed entirely to the contents of the book. Or when, in lively discourse, we accompany our words with corresponding gestures, all this goes on as a rule quite instinctively and without conscious volition taking any part therein. In the same way, a soldier marching while he sleeps, or an animal deprived of the cerebrum, makes a whole series of purposive movements without consciousness having any share in them. It is well known that in the

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sensational sphere a number of stimuli, which under other circumstances would be felt, remain unperceived, when consciousness or attention are vigorously attracted elsewhere.

That consciousness is *divisible* may be shewn by the fact that lowly animals (worms and polyps) may be cut into as many pieces as the operator pleases, and yet each piece will continue to live as a separate individual with a separate consciousness. *Lyonnet* cut up a naïs (a freshwater worm) into nearly forty pieces, and found that each piece developed into a complete animal. (See Darwin: Variation etc., vol. II, p. 351, ed. 1875.) This is true of a large number of lowly animals, which propagate themselves by simple fission, and so suddenly produce by mechanical division a double or treble consciousness from their previous single one. This principle of division extends in essence as far as the highest classes of animals and even to man himself, for in each generation of a new being a part or piece of the parental body is thrown off, which piece, as is well known, conveys to the begotten creature not only the physical, but also the psychical peculiarities of the begetter.

But we may go further and say that even in man the complete, fully-developed consciousness is not simple and unchangeable or indivisible, as spiritualists will have it. This is evidenced by cases — so frequently observed of late — of what is called *double* or *alternating* or changing consciousness, in other words, the doubling of the Ego, in which, on different days and at different times, the same man has a different consciousness and does not know one day what happened to him on another.

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A number of highly instructive facts of this description have been observed and recorded by *Schröder, van der Kolk, Jaffé, Krishaber, Azam, Galizier, Laveran, Camüset,* Dr. *J. Theyskens,* and others. According to Dr. *Krishaber* the remarkable condition of those affected with this malady may be best compared to that of a caterpillar which, while retaining its caterpillar reminiscences, is suddenly turned into a butterfly with all its senses and sensations. A deep gulf exists between the old and the new condition, *i. e.* between the caterpillar and butterfly state; the new sensative faculties cannot knit themselves on to the old, and the patient cannot re-discover them in himself; first he comes to the notion, "I am not I"; next to the conclusion, "I am some one else," or he seems to himself like a newborn child. Others experience a sensation as though they existed no longer; they feel their own bodies without being able to convince themselves of their reality; others again see themselves transmogrified into two persons. Sometimes every connective memory between the two conditions so completely breaks down, that the patient not only *thinks* that he is, but actually *is* another person. If the second condition becomes the normal or permanent one, as was observed in the case of *Felida X.* (1859—75), then a part of the earlier life is perfectly obliterated for the sufferer. In the case reported by Dr. *Camuset* (Annales médico-psychologiques, Jan. 1882), one year had completely vanished from the memory of a youth of seventeen.

These remarkable phenomena, the study of which does more to elucidate the nature of the Ego and of consciousness than whole volumes of metaphysical

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dissertations, owe their origin, according to some, to a periodical cramp of the blood-vessels that nourish a certain part of the mesencephalon; according to others they are due to an irregularity in the working in the two hemispheres. They shew that the consciousness of Ego is but a changing form of the totality of our sensation, and that it only remains the same as long as these pursue an accustomed and uniform course. As soon as any interruption occurs, the consciousness of Ego changes in its turn. The most rapid changes are represented by cases of double consciousness; the most regular and gradual by the above-mentioned variations and transitions that occur in the normal progress of life. The consciousness of the greybeard is other than that of the mature man; that of the mature man differs from that of the youth; that of the youth again is not the same as that of the child. The consciousness of the man who has grown wealthy, is other than that of the poor man; that of the *savant* other than that of the student. The consciousness of the invalid differs from that of the healthy man, and so on. Therefore, all those cases of double consciousness can only be looked upon as the superlative degree of a natural physiological condition and process, and regarded from this point of view, they scarcely deserve the name of "disease." Besides, those who suffer from double consciousness are perfectly rational and in no sense mentally diseased. The Ego only remains the same so long as the sensations are the same; it changes with their change, and re-appears so soon as these return to their normal condition.

The theory of the unity and immateriality of

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consciousness, as set forth by spiritualists, likewise rests but on self-deception and ignorance of facts. The mere circumstance that consciousness is united to the activity of the ganglia or nerve-cells spread over so large a surface as the grey envelope of the cerebrum, or rather that it is the expression of this activity, militates against the very thought of such a spiritualistic unity; and the theory is still further disproved by the well-known fact that with the loss of certain parts of the brain by wounds whole periods of life may vanish from the memory of the wounded person. The unity of consciousness can only exist in this sense that the person to whom it belongs is one, and has his organic centre in the correlation of the whole nervous system, just as the body is composed of many individual parts, and yet presents a unity, without being, on that account, one and indivisible, like the first French Republic. Physiology has not yet succeeded, and never will succeed, in finding a single spot in the interior of the brain for consciousness; the famous *sensorium commune*, the general centre of the brain, wherein, according to the ancient views, all sensations met, thence to pass to the *motorium commune* or general centre of all movements, has long since been consigned to the limbo of physiological fables.

But even the discovery of such a point would not satisfy the spiritualistic demands, for consciousness as an immaterial thing cannot be conjoined to an extensible, but only to an inextensible, that is to say, a non-existent spot. But seeing that a blow on the head, or a few drops of opium, or a few glasses of wine taken in excess, or a passing cramp of the

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blood-vessels, or a slight loss of blood, or the action of abnormally changed blood on the ganglia, is sufficient to make consciousness disappear or throw it into confusion, the idea of its immateriality cannot seriously be entertained. Consciousness, like thought, is a performance or action or phenomenal activity of certain parts or tissues of the brain, and in that capacity it is subject to all the changes which take place in the condition, nutrition and growth of the brain. But the question as to whether, as *Meynert* thinks, capacity for consciousness is latent in the essence of the atom itself, or whether it is to be regarded as the result of a certain mode of atomic union taking place under certain conditions and circumstances, may for the present remain unanswered. How and in what way the atoms, the nerve-cells, or, to speak generally, matter began to produce and bring forth sensation and consciousness, is quite unimportant for the purpose of our investigation; *it is sufficient to know that such is the case.*

Upon all these grounds, the endeavours lately made by a renowned modern physiologist, amid the applause of spiritualistic triflers, in order to prove that consciousness cannot, and never will, be explained by material conditions*), appear wholly vain and useless, proceeding, as they do, from an erroneous basis. How can it be thought possible to explain consciousness from material conditions, while matter itself is not understood, and while we are unable to give an adequate account entering into the very

*) E. Dubois-Reymond. Essay on the Limits of the Knowledge of Nature. Leipzig 1873.

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heart of Nature, of a single phenomena or natural force? If the progress of our knowledge and of our convictions were made to depend on answering such questions, we should probably have to remain for ever where we are now. On the other hand we know with absolute certainty that all existence, including sensation and consciousness, is one and self-dependent, ruled without exception by the law of cause and effect, and that no breaking through these boundaries set up by the necessity of Nature is possible at any point or at any time. Herr Dubois-Reymond will be the less prepared to deny this, as he himself had, on other occasions, stood up so vigorously for "the law of mechanical causality." But this is perfectly sufficient to vindicate the monistic standpoint, not only in questions relating to the brain and the mind, but also in questions of consciousness as the only accurate method of proceeding, since in macrocosmic matters it has long been regarded as the only tenable one. It is true that with this view disappear all those unscientific and chimerical hopes with which philosophical and religious spiritualism has so long fascinated the mind of man after the fashion of Puck, and of which we shall speak more in detail in a subsequent chapter. It neither can nor should be denied that the transitory nature of the consciousness, to which matter has gradually attained in the mind of man, stands in an unsatisfactory opposition to the moral feeling of the individual, and that in all ages this opposition has rightly called forth countless bitter complaints from poets and thinkers. But to turn that feeling, as unfortunately many do, into a starting-point for philosophical conviction, amounts,

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as *Wiesxner* says, *to philosophizing with wishes instead of with truths.**)

*) Compare on the question of consciousness and the disquisitions of Dubois Reymond the Author's fuller expositions in "Physiologische Bilder," vol. II, pp. 179 *et seq.*

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SEAT OF THE SOUL.

Physiology teaches us with absolute certainty that the brain is the seat and vehicle of our reflections and sensations.

Beneke.

Who therefore, is to remain unmoved at this idea of the seat of the mind? We stand astonished before the fane within which the intellectual forces act and work, before the enigmatical forms, which throughout all the life and work and doing and performing of the human race from the beginning even until our own time, have carried on their mysterious play.

Huschke.

Narrow is the world, and wide is the brain.

Schiller.

The brain is not only the organ of thought and of all the higher intellectual abilities, which have their exclusive seat in its grey layer, but it is also the only seat of the *soul*, taking that word as signifying the activity of the *whole* brain in all its parts, and including the sensorial and motive functions or the sensational and volitional acts, induced of the central grey ganglia, as well as its control over the whole nervous system. The word "soul" represents the inclusive and general, the word "spirit" the narrower and particular conception; and thus we speak of the "soul" or *anima* of animals in a general, but

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of the "spirit" or *animus* in a very limited sense. Therefore, the principle of the soul may be traced through the whole organic world down to the lower and lowest animals, wherein it is only joined to single nerve-spots or to the nerveless body-substance, and may be followed even down to the plants, in which it is represented at its lowest stage as an excitability without consciousness and without sensation. The *animus*, on the other hand, is but the product of the activity of a single centrally placed nervous structure, and grows in strength in the same ratio as the principle of the division of labor and of the differentiation of the individual parts or divisions of the nervous system gradually increases.

So long as the soul was regarded as a self-contained, immaterial being or unit, which was but temporarily and transitorily joined to the body, it is readily understood that a special "seat" or dwelling-place within the latter was eagerly sought for.

Yet it is an averred fact that *Hippocrates*, the Nestor of physicians (500 B. C.), the philosopher *Plato* and the Greek physician *Galen* (born A. D. 131), whose system of medicine ruled supreme for nearly fourteen centuries, regarded the brain as the seat of the soul, at least of what they distinguished as the rational or reasoning soul. But Plato's pupil *Aristotle* swerved from this correct view, and sought for the seat of the soul in the heart, which organ, as everybody knows, is set down in the Old Testament as the seat of all intellectual activities, and which, even now, is looked upon in that light by the Chinese. The philosophers *Diogenes* and *Chrysippos* shared this opinion, while other Greek philosophers considered the

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peculiar seat of the soul to be, some in the blood, others in the breast. So far as that goes, it may be said that many arbitrary notions were current among the ancients on this matter, for most of their philosophers distinguished several specific kinds of souls, and were therefore obliged to find for them different seats in different parts of the body.

More accurate views became prevalent during the sixteenth and seventeenth centuries, in consequence of the progress of anatomy and physiology. Thus, *Thomas Willis* (1664), recognizing at that early date the importance of the grey matter and of the convolutions, looked upon the whole brain, and more particularly upon the *corpora striata*, as the organ of the intellect. But the firmly established opinions of philosophers and theologians on the nature of the soul prevented this more correct view from making its way, and great, though nugatory efforts were made to discover the peculiar seat of the soul now in this, now in that individual part of the brain, losing sight all the while of the fact that it could only be based on the activity of the whole organ. Most acceptance fell to the view of the French philosopher *Descartes* or *Cartesius*, who pointed to the *pineal gland* as the peculiar seat of the soul, an organ about as large as a pea, situated in the interior of the brain and filled with the so-called brain-sand. This body seemed specially designed as the bearer of a single and indivisible soul-being, partly because it is the only unpaired organ of the brain, partly because of its connection with the ventricles, which are the accepted gathering-places of the nerve-spirits. Even down to the times of the great philosopher *Kant* (1724—1804)

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— the man who is at this day extolled by the whole gang of hired old-world philosophers as the last deliverer from the distress wrought for them by the materialistic and monistic views of the age, and at whose sight, as at that of Medusa's head, all opponents are to be turned into stone — people were so puzzled or so ignorant about the matter, that Kant, supported by the famous Frankfort anatomist, Sömmering, sought the peculiar seat of the soul in the small quantity of water or watery serum which is found in the interior of the above-named ventricles.

Among moderns, *Ennemoser* made by speculative means the ingenious discovery that the soul *resides in the whole body*, while the philosopher *Fischer* of Basle feels no doubt that *it is immanent in the whole nervous system.*

Philosopher are wonderful people. The less they understand of a thing, the more words they make over it. They seek to explain the mystery of the world "as though they were God's spies" (King Lear.) They have as many opinions as they have heads, and as *Bacon* very forcibly says, they become through their speculations "like owls that only see their dreams in the darkness, but become blind in the light of experience, and are least able to perceive that which is clearest." As *Spiller* remarks, they possess the most extraordinary talent for bringing the simplest things into the most boundless confusion, and they water and plaster over the simplest ideas and opinions with such a mass of high-sounding, apparently learned, but in reality empty and unintelligible words and phrases, that a rational man loses his senses over it. But the moment we go to the root of the matter, we,

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as a rule, are very soon convinced that the whole tirade is, as *Helvetius* says, "a deluge of words, poured out over a desert of ideas," and that the "hollow verbiage about being and not-being" (Suhle) and similar philosophical technicalities can have no other object but that of hiding the utter scantiness of real ideas and thoughts from the uncritical reader or listener. Most of the intellectual products of these gentleman may be aptly described by the beautiful Arabic proverb, already applied to them by Schopenhauer: "I hear the mill clattering right enough, but I do not see the meal."

In order to save themselves from the straits to which they had been put by the enormous progress of realistic science, resulting in materialistic and monistic pressure on them, they have, as we remarked just now, fallen back on the old philosophical school-master *Kant* and his well-known theory of perception, and in doing so, have sacrificed whatever had been achieved *in philosophicis* for the last hundred years. The future will shew whether they will derive any benefit from falling back upon a thinker, who was utterly unacquainted with the whole vast material of present science and knowledge, more especially the application of the fruitful thought of the evolutional theory to the origin of the human mind. At all events they have, in doing so, borne witness to their own intellectual poverty, than which no greater can be found.*)

*) With respect to this strategic retreat, compare the details in the Author's work on Man, quoted already in p. 69 of this book. The Author would also refer to a work he has in preparation, entitled, "Der erkenntniss-theoretische Skepticismus der Gegenwart und der Kant-Schwindel," in which the objections urged against his

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Yet they do not hesitate to abuse as "incapable of philosophic thought" those who are not imposed upon by their gibberish, but who see the poverty-stricken nakedness beneath the threadbare covering; an *argumentatio ad hominem* which might much more pertinently be rolled back on themselves by the empiricists. For heedless of the progress of empiric or natural science, they go on tilling their old philosophic soil and behaving as though there were no science in existence whenever they are threatened by it with a destructive interference in their metaphysical speculations.

The philosopher *Fischer* of Basle says: "That the soul is immanent in the whole nervous system is proved by the fact that in all parts of it it sensates, perceives and acts. I do not feel pain in a central point of the brain, but in the affected spot itself."

And yet what Fischer contends against is undoubtedly true. The nerves themselves do not feel, but they produce sensation only by conducting the impressions they receive to the brain. We do not feel the pain in the spot in which we are struck or injured, but in the brain. If a sensory nerve be divided anywhere in its course between periphery and brain, the sensibility of those parts of the body to which that nerve was distributed ceases at the same moment; this can have no other reason but that the conduction of each impression to the brain is no longer possible by the mediation of that nerve. We do not see with the eye nor with the optic nerve,

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ideas from the point of view of the theory of perception will be subjected to a searching examination.

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but with the brain. Divide the optic nerves, thereby destroying their conductive power, and seeing is at an end. The same thing happens if the *tubercula quadrigemina* which are a part of the brain, are cut out or destroyed in a living animal, although his eyes may be perfectly well preserved.

Nothing but custom and outward appearance have led us to the false belief that we feel in those parts of our bodies which are incited from without. Physiological science terms this remarkable relation the "law of eccentric phenomena." According to this law we erroneously trace the sensation that has been brought to the brain to the place in which we saw the stimulus applied. It is therefore very immaterial in what part of its course a nerve is stimulated; we always feel the impression in the peripheral extremity of the nerve only. If we strike the elbow nerve, we feel the pain in the fingers, not in the elbow. If an exostosis presses on the facial nerve at its exit from the cranium, the patient suffers from intolerable pain in the face, although the peripheral nerves of the face are perfectly sound. If a piece of skin be cut off the forehead and transplanted to the nose, the person on whom the operation has been performed fancies, if his new nose is touched, that he has been touched on the forehead. If the optic nerve is stimulated after the eye has been removed, the patient has the sensation of light and fire, although his eye can see no longer. Persons who have suffered *amputation* have felt pains in their amputated arm or foot, upon recurring changes in the weather, during the rest of their lives, although the limb itself is gone; without thinking of this enforced absence, they often

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try to touch it, because they have experienced a sensation therein. If a man had all his limbs cut off, he would none the less imagine that he felt them all. But this could not and would not be the case with a person born without them, because he has never had the experience which refers the eccentric position of the sensation in the absent limbs to the outside.

The whole of these facts go to shew that a definite topographical plan must exist in the interior of the brain, by the help of which the different sensations from the thousand different parts of the body are distributed each in a separate fashion. Each spot in the body which can separately feel, must have within the brain an exactly corresponding spot which brings it, as it were, before the forum of consciousness. It may easily happen that a vibration brought to such a central point by the nerves connected with it may not be limited to that point, but may also affect the neighbouring centres of sensation. In this fashion the so-called *sympathetic sensations* arise. If anyone is suffering from a hollow tooth, it is usually not only the tooth which aches, but the whole cheek too.

What is true of *sensations* is equally true of the *impulses of the human will.* It is not in the muscles but in the brain that the will to make a movement is excited, and only in the brain can the volitional act be brought about. The nerves are the conductors of this impulse, the messengers, as it were, who carry to the muscles the commands of the brain. If the conduction be destroyed, every volitional activity ceases. Persons suffering from spinal disease are lame on their feet, because this disease interrupts the nerve-communications between the feet and the brain.

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Apoplexy is the exudation of a quantity of blood from its vessels into the interior of the brain. At the same moment in which this exudation takes place to a sufficient extent to suspend the functions of the brain in that spot, every kind of sensation and movement completely ceases in the whole corresponding half of the body. Who has not observed the pitiable condition of a person struck with apoplexy? Just the same condition is induced in living animals by an artificial scission of the spinal cord in all the parts of the body below the division.

Like the sensory nerves, the beginnings of the motor nerves must be distributed in some topographical manner, in order that they may severally be set in motion by a volitional impulse. This relationship has been very felicitously compared to the keys of a piano, on which the will performs its play, as it were. Like the piano player, the will requires long practice and habit to acquire this skill, so as to produce *special* movements by striking *special* keys. Very often it does not succeed, but strikes several keys simultaneously, thus producing *sympathetic movements*. We want to move one finger, and instead of that we move several, perhaps all of them. Grimaces or gestures in speaking depend on this principle of sympathy. Sympathetic movements are most frequently observed in young children, who have not yet learned to isolate their volitional activity. If a child wants to make the simplest movement it moves its whole body.

The more recent investigations and experiments, made by Broca, Ferrier, Munck, Fritzsch, Hitzig. Nodnagel and others, on the localisation of the functions

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of the brain, have shewn beyond all doubt that a division of labour exists in the brain similar to that which obtains in the body generally, and that each bodily division, nay each single muscle has corresponding to it a certain spot in the central organ. In complicated or co-ordinated movements a number of the central elements work together, as *e. g.* in the faculty of speech, for which a definite centre has been discovered, situated in the fore-part of the brain-envelope of the left side in the cortex of the Island of Reil and the convolutions surrounding it. If these parts lose their functional activity by injury or disease, *aphasia* or speechlessness supervenes.*) This much is certain, that by these and many other experiments which we could not very well particularise here, the erroneousness of the old view has been fully proved, according to which all mental functions were distributed over the whole cerebral grey layer, an error first suggested by *Flourens,* a French *savant,* to which a great many people still adhere. The soul is not a sort of aggregate functional activity of the cerebrum, but each individual part of the cerebrum has its own work to do. Thus we must assume that other parts serve the memory, others again represent the faculties of imagination, reasoning and judgment, others the impulses of voluntary movement, and others diverse descriptions of impetus, feeling, sensation etc. It appears also to be beyond doubt that our higher and lower psychical lives are *entirely divided anatomically* within the brain itself, and that while imagination,

*) Further details on this and on the question of the localisation of functions will be found in the Author's "Physiologische Bilder," vol. II. pp. 140 *et seq.*

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judgment, reason, thought, conscious feeling, desire and volition only go on in the grey substance of the outer layer of the brain, the lower sensorial and motor acts (including reflective or unconscious nerve-actions) have their centre in the central grey ganglia or the grey nuclei of the mesencephalon. This grey central mass is connected on one hand only by the nervous system with the whole body, and on the other hand is united by connecting fibres, in the most intimate and direct manner, with the grey cerebral layer and reflects all the impulses reaching it from the body on to the special seat of the Psyche and of consciousness. These impressions or messages coming from without are delivered up to the sensory cells and thence proceed to the imagination cells, in which they are translated into ideas and thought, and by radiation on the motor cells where they are turned to movements or volitional acts.*)

Now let us see what another philosopher has to say on the same subject. Professor *Erdmann* of Halle remarks in his psychological letters:

"The view that the soul resides in the brain, consistently carried out, must lead to the conlusion that if the remainder of the body should be taken from the head the soul might continue to exist therein!"

This would, in point of fact, be doubtless the case if we were able to artificially supply to a severed head the nutrition and the maintenance of the metabolism of the brain by infusing the blood neces-

*) The more closely considered basis of this view will be found on pp. 166 *et seq.* in the Author's work mentioned in the last note.

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sarily associeted therewith.*) But when the severance takes place, the blood supply from the heart at once comes to an end, and with it all consciousness, every function of the brain, every psychical activity and all life ceases.

A few instances have occurred of men having the upper part of the spinal marrow so compressed by the dislocation of one of the cervical vertebra, that the communication between the body and the head was completely cut off. Respiration and circulation and along with these the nutrition of the brain continued, though imperfectly. Such unfortunates are dead while living. The whole body is entirely bereft of sensation and motion; it is a *corpse*: life continues

*) Since the above statement was first written, it has been thoroughly borne out by physiological experiments. If the head of an animal, such as a dog or cat, is cut off, the severed head gradually loses its irritability; the eyelids close, the eyes become dull, the nostrils motionless. But if at this moment arterial defibrinated blood is injected into the arteries, the previously dead head gradually revives; the eyelids open, the nostrils expand, heat and sensation return, the eyes grow bright again, and looking at the bystanders, turn in their orbits. If the animal is called by its name, the eyes turn to the place whence the call proceeds. These signs of returning vitality last as long as the injection continues, and disappear and return again as the operation ceases and is resumed. This interesting experiment has not yet been made with any decapitated men, but it may be safely inferred that exactly the same result would follow. *Brown-Séquard,* to whom we are principally indebted for the above experiments, has tried the same plan with a newly amputated *human* arm, which had become cold and senseless. After a few moments heat, irritability, contractility, in fine all the normal activities returned to the dead limb, and Dr. *Brown-Séquard* was able to continue the experiment with the same result until fatigue compelled him to stop.

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only in the head and in the immediately adjacent parts to which nerves are distributed from it. *The psychical existence, however, of such injured persons remains perfectly unimpaired, at least for a time; they are as it were, living corpses.*

The thesis that the brain is the seat of the soul is so firmly established, that for a long time past the legal enactments relating to monstrosities have been founded upon it. A monstrosity with one body and *two* heads counts as two persons, whilst such a creature with *one* head and *two* bodies counts only as one. Monstrosities *without* a brain, the so-called *acephali*, have no personal status in law. Lastly, Herr *Ennemoser* has discovered that the soul *resides in the whole body*. If Herr *Ennemoser* had been unfortunate enough during his life to lose a leg by amputation, he would have found by experience to his no small surprise that his soul-life and his psychical existence had thereby experienced no essential injury or alteration.

Quite recently, an attempt, based on experiments on animals, has been made among physiological scientists to weaken the hitherto unimpeached view that the only seat of the soul is in the brain, by attributing to the spinal cord a share in sensation and voluntary movement, and founding thereupon the well-known theory of the so called spinal-cord-soul. These experiments prove nothing, at least for men and all the higher vertebrates, while the reasons militating against it are so strong and so general that science, at any rate up to the present time, has not been able in any way to accept such a limitation.*)

*) Consult on the spinal-cord-soul and the deductions hastily

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There is one additional thing that must not be lost sight of, and this is that those who look upon the soul, not as a resultant of the brain-substance, but as an *ens per se* or a self-existent being, have frequently contended that the soul, under certain circumstances and for a brief spell of time, might leave its seat in the brain and take up its residence in some other part of the nervous system. As such a part has been especially mentioned the *solar plexus* — a plexus or network of the *sympathetic or vegetative, sometimes termed ganglionic or visceral nervous system*, — situated in the upper part of the abdominal cavity. This nervous system, running down each side of the vertebral column, with numerous ganglia and outgoing nerves, and regulating the visceral movements connected with nutrition, generation, and secretion, is closely united by numerous fibres, both anatomically and physiologically, with the brain and spinal cord; it nevertheless maintains a certain independence recalling the conditions of the lower animal world, by means of the numerous ganglia or nerve-knots containing grey matter; and by its separation from the sa-called *animal* nervous system, that is to say from that which relates to sensation and motion, it represents one of the most important advances brought about in the perfecting of the animal economy by division of labour. Without this division of labour the animal life or psychical life embracing the province of higher nervous activity, could not possibly attain to that high degree of perfection and capacity for work which

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made therefrom by philosophers, pp. 407 and 408 of the above-quoted work of the Author.

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it reaches in man and in the higher mammalia, whilst the life of the lower and lowest animals exhausts itself more or less in the lower activities of the sympathetic system. Therefore, however great may be the part played in these lower activities and in the whole process of nutrition of the body by this sympathetic system, it is yet in no way concerned with the duties of the central organs of the animal nervous system, or with psychical actions proper. Notwithstanding this, people have not hesitated in setting this harmless nerve down as an accessory to the mystical and speculative sins of our time, and charging it with a share in the phenomena which are generally designated as the *night-life of the soul.* Thus, for instance, this nerve is stated to enable somnambulists, or persons under the influence of animal magnetism, to read sealed letters or to tell the hour on watches held, while their eyes are closed on the pit of their stomachs, and lots more of the same kind.

We deem it our duty to go more thoroughly into the most important of these phenomena, partly to vindicate our opinion that the peculiar seat of the soul is in the brain, partly and still more so for yet another reason. An attempt has been made to take advantage of some of the phenomena alluded to, especially those of *clairvoyance,* second sight, presentiments, dreams and lately even the gross deceptions of spiritualistic jugglers, in order to prove the existence of supernatural and supersensual powers and manifestations. Within them has been sought the certain, though obscure point in which the spiritual and human worlds are thought to meet; people have even gone so far as to point to these phenomena as the

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door through which might some day be seen the dawn and the sure and certain promise of a transcendent existence, of the realm of spirits and of God, and of future life. It was hoped also that by this method we might come on the track of those unknown and mysterious "things in themselves," which, according to the philosophers, are hidden behind the phenomenal world which is alone accessible to our methods of observation, although the simplest reflection would have shewn that, if understood but approximately, they would no longer be "things in themselves." Even so great a thinker as *Schopenhauer* was so far misled by his philosophical doctrines as to believe with enthusiastic faith in the artifices of a peripatetic magnetiser called *Regazzoni*.*)

All these things, so far as they relate to life outside or above nature, appear as mere idle fancies before the clear eye of science and experimental investigation; fancies to which human nature has at all times resorted, in order to appease its longing for the miraculous and the supersensual, handed down to it from ancient reminiscences. This longing appears now in one, now in another form, according to the changing conditions of the age. The selfsame superstition which in former centuries was represented by belief in witches, wizards and evil spirits, by the notions of *diablerie* and of people being possessed of demons, by vampyrism and similar delusions, appears in a modern garb as table-turning, spirit-rapping, and spiritualism, as psychography, somnambulism, and so on.

*) Consult the Author's work: "Aus Natur und Wissenschaft," pp. 129—131.

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No doubt, educated people often consider that belief in miraculous and supersensual things is a special characteristic of the uneducated classes; but the contrary has been strikingly shown by the "fluid-mania," and by the success which, in the best classes of Society, has attended the legerdemain and clap-trap of magnetisers, clairvoyants, thaumaturgists, spiritists, hypnotists, and other jugglers.

Among the phenomena constituting the *night-life of the soul* are usually reckoned: The startling of pregnant women, animal magnetism with its accompanying phenomena of clairvoyance, the conditions of sleep, sleep-walking, and somnolency, presentiments, second sight, ghostly apparitions, and sympathetic or miraculous cures.

The *startling of pregnant women* has no particular bearing on the subject we are dealing with, being as a rule relegated at this day by the best authorities to the realm of fables.

Magnetic sleep, sometimes caused by continued stroking of the body, and sometimes called forth without such contact and without any definite external reason — as in *idiososomnambulism* — is alleged to result in a state of unconscious *spiritual ecstasy,* which occasionally, and in the case of some specially endowed persons, chiefly women, rises into veritable *clairvoyance.* While in a state of ecstasy, the patients are said to reveal greater intellectual power than is habitual with them; they speak fluently in foreign tongues and in other and more complex dialects than their own, and on matters of which, while awake, they are perfectly ignorant. The magnetised are said to have something ethereal or illuminated about their whole

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person, reminding us of their direct relation with the supernatural; their voices are clear and solemn. If this condition reaches actual *clairvoyance*, they are stated to be able to give accurate information of things lying outside the natural purview of our faculties, to read sealed letters, tell the time marked by a watch laid on the pits of their stomachs, read the thoughts of others, see into the future and at a distance, and so on. Lastly, such persons give revelations about heavenly things and things of another world, about the goings-on in heaven and hell, the condition of things after death, about spirits and the souls of departed persons, etc. etc.; but it has been noticed that these revelations always agree in the most remarkable manner with the views of the churches or clergy under whose influence the somnambulist happens to be.

Clairvoyance, in its present *form*, but not in its *essence*, is an invention of modern times. Among the ancient Greeks, the soothsaying *Pythoness* on her tripod was a *clairvoyante* of an antique kind, who was prompted by the hierophant to give her answers, the same as the answers of our modern somnambulists bespeak prompting. During the middle ages, the various outbreaks of *religious insanity* brought similar manifestations of inspiration in their wake. An interesting example of this sort is yielded by the often-repeated stories of the *exaltés* in Languedoc. An instance of *modern* inspiration, almost more remarkable than the foregoing, is offered by the "mediums" in America, who pretend that they are employed by spirits hovering between heaven and earth to make writings oftentimes very voluminous, known to

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the public. Mediums receive their inspiration in a half unconscious condition, and write down things which far transcend their knowledge and ability. One of the most notable and most celebrated of these mediums, *A. J. Davis*, living near New York and writing in a theosophical sense, had made so close an acquaintance with the spirits that he could give their weight within three or four ounces!

There can be no scientific doubt that *all* alleged cases of actual *clairvoyance* or supernatural inspiration rest on fraud or illusion. *Clairvoyance*, that is, perception beyond the natural reach of the senses, is, on physical grounds, an impossibility. It is a natural law, which can be denied by none, than man requires eyes to see and ears to hear, and that the senses are subject to a certain limit in space, which they are unable to exceed. No one can read an opaque sealed letter, nor see from Europe to America, nor look into the future, nor read the thoughts of others, nor perceive with closed eyes what passes around him, nor perform intellectual work which transcends his knowledge or ability. These truths rest on natural laws which are immutable, and of which, by analogy with natural laws generally, it may be said that they admit of no exception; none the less there are philosophers who hold that in the somnambulist the subject is relieved of the non-real but merely subjective limits of time and space, and that therefore an insight into the future and into distance is conceivable and possible.

In reality it has never been possible to substantiate such a deviation from the regular course of Nature; or, in other words, no reasonable and unprejudiced

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person has ever observed such a deviation. Spirits, ghosts and miracles have, until now, been seen only by children or by imbecile and superstitious people. Whenever such pretended supersensual manifestations have been closely looked into, they have come to nothing. All the twaddle about the intrusion of a higher or spiritual world into ours, or of the existence of departed spirits, has been found to be unmitigated nonsense. No dead man has ever yet returned to the earth. There are neither table-turning nor other spirits. "Science," says F. A. Lange, "knows but one kind of spirit, the *human*." All this admits of no doubt in the eyes of the scientist who has trained himself by observation and experience of Nature; constant contact with Nature and her laws has imparted to him a deep conviction that these laws admit of no exception whatsoever. No doubt, the majority of people, that is to say the great multitude, think otherwise, for they are always inclined to give more credence to one fool than to the sayings of seven wise men. There is no help for them but education.

The absolute impossibility of the existence of such a thing as *clairvoyance* having been conclusively proved by science, each alleged instance of such second sight has been shewn by sober and trustworthy observers to rest on mere deception or delusion. As far back as the year 1783, when the famous magnetiser *Anton Mesmer* happened to be in Paris, a scientific commission, headed by the famous *Bailly*, made a full report on the subject, in which, as the result of a careful examination, it was stated that the whole matter was a downright swindle, resting upon hallucination, deception of the senses, excitement of the

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imagination and tendency to imitation. The Paris Academy of Medicine arrived at the same result by numerous and searching experiments. In the year 1837 this Academy offered a prize of 3000 francs to any one who would, within three years from that date, read through a board. *No one obtained the prize.* In the year 1853 a scientific commission appointed *ad hoc* at Geneva went through a number of experiments with *M. Lassaigne* and Madame *Prudence Bernard,* a celebrated Paris *clairvoyante,* but the result was purely negative. Clairvoyance has been nowhere, whenever proper rules have been made to exclude fraud and deception. In the same year 1853, *Louise Braun,* of Berlin, the well-known "miracle-working maiden of the Schifferstrasse," who, for four years, had deceived thousands of people and had actually been asked by the highest authority in the land to restore sight to a blind king, was convicted by a jury as a common swindler. In the year 1857, Prof. *Fenton* of Boston offered a prize of 500 dollars for clairvoyance or for the exercise of supernatural powers, as for instance playing a piano or tilting a chair without touching the object. No less than fourteen of the most famous American mediums tried for it, but without result. One of the four professors of the commission presided over by the famous *Agassiz* declared on June 29, 1857, that the whole was deception and fraud, and cautioned the public against such practices. It is nevertheless true that among the clear-headed Yankees spiritualism flourishes to a large extent and that year by year it supplies hundreds of inmates to the lunatic asylums. The contagious nature of this description of mental disease

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has been lately (1878) shewn in an Italian town in the province of Udine, where one person who professed to be possessed with "evil spirits" gradually made a large number of possessed people (mostly women), of whom some claimed to be prophetesses and *clairvoyantes*. The district was finally put under martial law, and seventeen of the "possessed" were conveyed to the asylum at Udine. (Compare the report of Dr. *Colin* in the "Annales d'hygiène.")

The author has had an opportunity of carefully watching a *clairvoyante*, of whom remarkable stories were related, under circumstances in which fraud or any idea of personal gain on the part of her magnetiser was hardly to be thought of. In this instance, the *clairvoyance* of the lady proved such a dead failure that all the revelations she made were either false or else expressed in such general terms that there was really no meaning in them. During the clairvoyant state she gave the most ludicrous reasons for her blunders. Her clairvoyance having turned out an egregious failure, she passed into a state of celestial ecstasy, in which she conversed with her *Ange* or guardian angel, and repeated religious verses. In doing so, she once came to a dead stop, and to assist her memory, had to begin the stanza over again. No such thing as a condition bespeaking higher intellectual faculties was revealed during her ecstasy; her diction was quite commonplace, and her expression awkward and uncultured. The author left her with the conviction that she was a impostor, who deceived her protector. Yet there were gentlemen in the company who would not believe that there was any fraud!

After all that has been said, it cannot be doubtful

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that such supersensual and supernatural powers do not exist and can never have existed, and that there is no sense in the statement that the soul under such circumstances flies from the brain to the sympathetic system and there unconsciously achieves unnatural things.

Sympathetic or *miraculous cures* all rest either on fraud or on imagination, except so far as the psychological power of faith or of imagination may come into play. Their range is as wide as the world and as old as history. Homer's great hero, *Achilles,* possessed wonderful powers of healing in his right toe, and *Plutarch* relates that king *Pyrrhus* healed hypochondriasis by rubbing with his right toe. In Egypt, the emperor *Vespasian* performed miraculous cures with his foot. To say anything further on the physical impossibility of such cures would be an insult to the understanding of our readers.

The same remark applies to the appearence of spirits in whatever form they may come, whether as regular ghosts, or as table and furniture spirits, or as Weinsberg demons, or as Davenport's press, bell or trumpet spirits. Such astounding aberrations of the human mind can only be met with the soothing words of *Vitale*, "that even the most ludicrous follies find heads that are made to believe in them."

As regards *forebodings* and *second sight* by which things or circumstances are seen or known that have happened, are happening, or shall happen at other times or in other places, and in which the prescience of death forms the principal part, all that has already been said of clairvoyance holds good for them as well. It is a sad sign of the times and of philosophic error

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that we find even excellent writers and learned men, prompted by the pressure of philosophical prejudice, who advocate such notions, and periodicals of high standing that are not above imbuing the public with such horrible nonsense.

The wide range of *dreams* has lately been turned to account in exactly the same way. Their psychological significance — or rather non-significance — has long been recognised by the common proverb: "*Träume sind Schäume!*" (Dreams are mere froth.)

Somnambulism (sleep-walking, lunacy, and somnambulism proper) is a condition of which, unfortunately, very little is known by exact and trustworthy observations. Yet, even without possessing an accurate knowledge of them, we are able to designate as fables and accordingly reject the mythical and absurd stories related about somnambulists. No somnambulist can run up walls, or speak in languages unknown to him, or achieve intellectual tasks which are above the reach of his faculties. Apparently there is nothing more than the mere outcome of memory in all that seems mysterious in the whole matter.

A certain form of artificially induced night or sleep-walking or artificial somnolency is termed *hypnotism* (from the greek word ὕπνος, sleep); this had been known for a length of time, but only of late has it been brought under general observation by the exhibitions of the Danish magnetiser *Hansen*. It is a condition of sleep or stupefaction, artificially induced by external influences on the nerves of the senses or of the skin, and generally accompanied by a loss of sensation, muscular rigidity and partial palsy of the nerves and senses; it apparently consists in a

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functional disturbance or suspension of activity in certain parts of the cortex of the cerebrum. It therefore belongs rather to the province of pathology than of physiology, for there are but few persons who, having a leaning that way owing to a certain irregularity in the condition of their nervous or blood system, can be thrown into hypnotism. In this case there can be no peculiar nor special power of the magnetiser or experimenter, nor can the phenomenon be traced to the development of supernatural capabilities, for all the experiments tried in this direction have completely failed; the whole effect is brought about by strictly natural causes. It is probable that hypnotism accounts for much that occurs at exhibitions of animal magnetism, which the public are unable to understand, *e. g.* the loss of sensation or a startling magnetisation from a distance; and it is not likely that a long time will pass before we shall find out the true nature of this highly interesting condition by accurate observations.

From all that has been said in this and in the previous chapters, we are led to endorse the words of *O. Ule,* who says: "It cannot be denied that perception by the senses is the source of all truth and of all error, and that the human mind is a product of metabolism."

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INNATE IDEAS.

Nihil est in intellectu, quod non fuerit in sensu.

There is in our mind nothing that has not been in our senses.

Moleschott.

The secret of direct knowledge is sensation.

L. Feuerbach.

The question whether there are such things as what Voltaire calls *idées innées* and Locke designates as *innate ideas,* is one of the oldest and in our opinion one of the most important items of research in Nature. By answering this question we satisfy ourselves also as to whether man, the product of a higher world, has received the form and environment of this existence as something alien and foreign to his own essence, with the tendency to shake off the earthly veil and to return to his spiritual origin; or whether he is in a necessary and indissoluble connection, in his spiritual as well as in his bodily nature, with the world that has produced and conceived him, and whether he has received his own essence from this world in such a way that he cannot be separated from it without perishing himself — as the plant cannot exist and live without the maternal soil. The question is not one shrouded in an impenetrable mist,

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but it has, as it were, flesh and bone to it and can be understood without that philosophic clatter of words, which too many people, unfortunately, still regard as the true language of wisdom. Happily, that philosophical labour of Sisyphus to which, in Germany, during the first half of our century, so many eminent men devoted their lives and their efforts to no purpose, has met with a stout barrier in our own time in the appearance of empirical or experimental science and the vast success achieved by it. The mere philosophical phraseologists with their obscure and prolix language are getting fewer and fewer every day, and the tendency of the age is an honest striving after philosophic truth and clearness and after the revival of a philosophy based upon the criticism of actual facts.

The French philosopher *Descartes*, or *Cartesius*, taught that the soul entered the body, armed with every possible knowledge, and having only forgotten it on leaving the mother's womb, gradually came to remember it again later on. The English philosopher *Locke*, the founder of Sensationalism (born 1632), argued against this view with great force and contended against the theory of innate ideas. According to him, all ideas spring on the one hand from experience and observation, on the other from inward reflection on that which has been acquired by experience or observation. In this he followed his famous countryman *Thomas Hobbes* (born 1588), who had taught even more plainly that all knowledge originated in external experience and that reason and understanding were nothing but reckoning with impressions arising from sensations and conveyed by the nerves. According to both, the course of knowledge is not

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from the general to the special or individual, but the reverse; the latter precedes the former.*)

Upon the strength of actual and incontrovertible facts we have no hesitation in declaring ourselves opposed to the theory of innate ideas, opinions, or truths, as set forth by Plato or Descartes. There are no prepared conceptions in our thought, neither are there any innate ideas or moral truths which remain unchanged at all times, under all climates, and among all individuals and nations. On the contrary; daily experience clearly proves that exactly the opposite is the case, and that in these things the greatest possible variety may be found everywhere. It further teaches us most conclusively that thought in man, as *Virchow* remarks, "develops but gradually," keeping pace, in doing so, with the number and importance of the impressions received, and with the working-out of these by the organ of thought. Man, the same as any animal, is developed gradually in the maternal womb scarcely to be distinguished in form and size from an insignificant plasm, by the eye, even with the help of the microscope.**) At a certain stage of this development, the embryo becomes capable of movement within the womb, but these movements are not spontaneous; they are induced by what is called reflex. The embryo does not think, it is not self-conscious, and when, as Prof. *Kussmaul****) assumes,

*) Consult on both philosophers and their teaching the Author's work on the Darwinian theory, pp. 378—385 of the 4th (German) edition.

**) Further details on the manner of this evolution will be found in the Author's "Der Mensch und seine Stellung in der Natur," p. 104, 2nd edition.

***) "Ueber das Seelenleben des Neugebornen." 1859.

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intelligence begins to develop in its lowest form, this takes place only by means of the obscure sensations which may be caused by touching the sides of the womb and by the absorption of the amniotic fluid. No trace of remembrance of this embryonic condition is ever found in man's after-life.

In connection with this it is important to glance at the somewhat ludicrous scientific discussion which has taken place as to the exact period of the *quickening of the human embryo*, a controversy which became of practical value directly the killing of the embryo began to be considered a moral and legal offence. Seeing that such a crime can only be committed against a *living* being, it was of the greatest importance to know at what period the personal soul assumed its seat or place in the embryo during the progress of gestation. The scientific and logical impossibility of fixing a date proves the absurdity of the whole theory according to which a higher power breathes into the fœtus or unborn being a ready-made soul, equipped with certain ideas. Accordingly, the Roman jurists put forth the view that the embryo should not be regarded as a distinct being, but only as a part of the maternal body, belonging to the mother and being within her power. The destruction of the embryo was therefore permitted by law and custom among the Roman women, and the Greek philosophers *Plato* and *Aristotle* declared themselves in favour of this custom. The *Stoics* considered that the child only received a soul when it first began to breathe. In the time of the Roman jurist Ulpianus (A. D. 200.), the destruction of the fœtus was first prohibited, and this indeed was owing to the influence

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of Christianity, which regarded the fœtus as an immortal being, partaking of Adam's fall, and therefore doomed to everlasting damnation if it was killed unbaptised. The *Corpus Juris* fixed the fortieth day after conception as the period of the soul entering into the fœtus! The later jurists were of opinion that conception, quickening and psychical life all occurred simultaneously — a view which is not consonant with scientific experience. Any one who has ever seen a human or animal ovum under the microscope, with the spermatozoa that have penetrated within it, can only smile at this idea of an egg-soul. No doubt, this germinal matter must be imbued with the physical and material tendencies and dispositions that are inherited from the parents, and on the basis of which its psychical or intellectual faculties are developed later on in the same way as its physical characteristics; but it would be utterly preposterous to speak of such a thing as a real psychical or spiritual stock existing therein, or of its innate notions, knowledge or ideas.

In earlier ages we meet with no such religious and philosophical exuberance as is inherent to ours and which often causes the simplest things to be looked upon in a false light. Moses and the Egyptians held the deliberate opinion that the child in the mother's womb has no soul. According to the morality of the *Talmud*, the unborn child is only a part of the mother, and artificial abortion is permissible. This was also the case throughout all antiquity, and continues the same now among a large number of non-Christian nations. In Arabia, the Islam was the first to put an end to this pernicious offence against public morals.

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Neither is it possible or conceivable that at the birth, or at the moment when the severance takes place between mother and child, a ready-made soul, that has been espying that very instant, suddenly makes its appearance and takes possession of the new dwelling, in the same way as the evil spirit entered the possessed. The psychical or spiritual existence of the individual develops gradually and very slowly as a result of the interaction that takes place between the individual and the external world by means of the awakening senses. It is, as we have seen already, quite possible, nay it seems certain, that in the womb, chiefly by hereditary transmission, the bodily organisation of the new individual acquires certain tendencies and predispositions which, at a subsequent period, when impressions from without arrive, will develop into intellectual properties and characteristics. Both among animals and men there may be transmitted, from parents to their young, gradually developed tendencies, mental habits, or dispositions of the nerve-system or the thought-organ, acquired during life, and tending in a definite direction; but a conscious conception, idea or clear intellectual knowledge can never be inborn *as such.**)

*) The sucking of the newly-born child at the mother's breast is not the result of a conscious thought or a voluntary act, but is purely *reflex*; in other words, it is brought about mechanically by the aid of a well-known process in the nerves, independently of volition and consciousness. The child therefore not only sucks at the breast, but at anything put into its mouth. There are also children who have to be taught with much trouble to suck properly. Here again inherited tendency or impulse may come into play. See *Schneider's* "Der thierische Wille" (Leipzig, 1880, pp. 161, 162). Altogether, if in the life of men or still more

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The theory put forward by *Rudolf Wagner*, one of our most distinguished physiologists, in conjunction with the philosopher *H. Lotze*, as though the existence of an immaterial, divisible and transmissible *soul-substance* were proved by the physiology of generation and the transmission of mental peculiarities from parents to children, is utterly untenable and rests on the false notion that the germinal matter of animals has actual psychical *contents*. Such cannot be divided, nor transmitted, nor inherited.*)

The further development of the *childish* mind, proceeding by sensational paths and in conformity to the teaching, training, and example received, always within the determinate limits of its bodily organisation and conditions, militates so clearly and irrefutably in favour of the objective origin of the soul that no theoretical argument is capable of shaking it. While the mind grows in strength and practice, while external impressions cumulate and are repeated, an internal picture of the external world forms itself slowly and gradually on the material basis of the existing organ of thought, and views, ideas and conceptions are created. A long and toilsome period

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of animals there are often found phenomena which have the appearance of innate ideas, these are always to be explained by the laws of "heredity," first set in the right light by the influenee of the Darwinian theory. On this question full and complete details may be found in the Author's pamphlet on "Die Macht der Vererbung" (Leipzig, Günther, 1882), as well as in the work by *Th. Riblot* on Heredity (Leipzig, 1876), especially on p. 338, which deals with the matter treated of here.

*) Further details on the theory of soul-substance and its scientific untenability may be found in the Author's work, "Licht und Leben," p. 302 *et seq.*

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must elapse before man reaches full self-consciousness and learns to gradually turn his organs and limbs to certain uses, and before he distinguishes himself as a *person* from the All. An illustration of this is that children never speak of themselves at the outset in the first person. This gradual, unbroken, and partly unconscious mental growth, causes man, in the sequel, when in full possession of his mental faculties, to forget his origin, to despise his mother, the world, and to regard himself as the direct son of heaven, from which he imagines that knowledge, or his whole conceptual world, has come as a spiritual gift.

But he is taught better by an unprejudiced survey of his past and a glance at those unfortunate ones to whom Nature has denied the possession of one or more of the senses, and who, such as deaf and dumb persons, can only be educated partially into a condition worthy of humanity. The same holds good of those unhappy creatures who, by avarice or cruelty, have been shut up as children in dark isolated places, and there held sequestrated of all human fellowship and kept without any mental impulse; or again of men who, from their earliest childhood, have grown up far away from human society, in woods, among animals, and so on. They live and feed like animals, they have no psychical sensation save the craving for food, and shew no trace of that godly inspiration or "divine spark" which in the spiritualistic view should be "innate" in man.

The animal world also affords clear proofs in opposition to the theory of innate ideas, although the so-called *instinct* of animals has been put forward as strikingly supporting this theory. In a future

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chapter we will try to shew that *nowhere there is to be found* an instinct, in the generally accepted sense of an unconscious, immutable, irresistible, never-erring natural impulse, directed to the achievement of definite objects, and whose origin can only be explained by divine or supernatural intuition; but that animals, like men, think, learn, perceive, experience and reflect, although in a less developed proportion or degree. More particularly are animals taught, like men, and do they learn by the influences of their surroundings, of parents, experience, age, example, etc., even though they may be moulded more than are men, to one or another mode of thinking, acting, or feeling, by the tendencies and dispositions of the nervous system inherited from their parents and ancestors. Thus, the well-known proficiency exhibited by song-birds in singing is by no means innate as such, but the innate tendency must be called forth and developed by teaching and example. Therefore the identical kind of birds, such as goldfinches, have quite different songs in different countries; many songsters imitate alien songs; and single birds, especially those that are reared in solitary confinement, always remain clumsy singers and sing strange notes; in some places there are no good singers, because the best have constantly been caught and can give no instruction; the yellow-hammer of Germany has a cadence quite different from that of the Alps; no two singers are found to be quite identical; and individual birds are often heard to regularly rehearse their songs.*)

*) Further details on the question of instinct may be found in the Author's work "Mind in Animals," Introduction.

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An attempt has also been made to use animals as living advocates of the theory of innate ideas, by arguing thus: Animals possess senses just the same as man does, and often much keener ones, yet they remain but animals. But those who adduce this as evidence overlook the general differences that exists between man and animal, especially the difference in the size and organisation of the thought-organ, as well as the difference of physical structure and of the conditions of life. The senses are not the producers, but only the mediators of intellectual qualities. They transmit impressions from without to the brain and nervous system, which elaborate them in conformity with their material nature and energy. *Without* the senses this whole process cannot go on, and therefore the senses are the source from which all knowledge arises directly. But even *with* the senses, however keen they may be, the process can only go on to a limited extent, when the thought-apparatus is not well formed or developed. In a former chapter we spoke at some length on the relationship that exists between the animal and the human brain. The brain possesses innate talents or dispositions to be active in one direction or another, but it possesses no innate ideas, views, conceptions or knowledge. Nay, all these talents and dispositions will ever remain without reality and without development, if impressions from without are wanting; these are just as necessary for the evolution of a real mental or psychical capacity as one chemical body is necessary to form a chemical compound with another.

The existence of certain general ideas or mental conceptions has been brought forward in refutation of the

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sensational theory; these, it is alleged, rule so largely and with such power, definiteness and generality in the life of the individual and of nations, that it is impossible to regard them as originating empirically or through experience; therefore, it is said, they must have originated in human nature as such, and be indelibly stamped thereon by a higher power. Among these are to be reckoned above all metaphysical, æsthetic and moral conceptions, such as the ideas embodied in the words true, beautiful and good.

These objections are easily met. First of all it must be remembered that what is called the ideal is not the work of a single individual, but is the intellectual blossom or fruit won by the whole race and by the united toil of many centuries and countless generations. The ideal thus gradually acquires a certain historical right and objective form, so that in time the individual is no longer obliged to personally go through the whole process from the beginning, but only needs to take in that which exists already; and in doing so he is powerfully assisted by the disposition of his organs of thought towards this special form of activity, inherited from his parents and ancestors. Only slowly and gradually the aboriginal primal man, tossed about wildly by the storm of his animal desires, rose from mental inanity to the idea or ideal.

"Art, poetry, science, morality, all these highest manifestations of the human mind," says *Ribot* (*loc. cit.* p. 390), "are like a fragile and costly plant, that has come up late and been fertilized by the long toil of countless generations. — The ideal has not revealed itself once and for all; it unveiled itself gradually."

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Without this necessary retrospect at the historical evolution of the ideal, it may appear to the individual — who has acquired it from the first moment of his existence by a thousand invisible threads, and who suddenly finds it in his consciousness — as though that ideal must necessarily be innate. But it could never have been evolved in historical time without that definite relation of the objective world to the perceptive faculty of the individual. It therefore bespeaks a very limited range of ideas to be so much bound up in supernatural notions as to say, like *Liebig*, that we do not know "whence the ideal originated."

The same argument holds good for "*a priori*" ideas relating to certain forms of thought or perception, such as *time*, *space* and *causality*, with regard to which many philosophers maintain that they were originally implanted in our minds prior to and independently of all experience, and that we are therefore only able to think according to these forms. This latter remark is doubtless true, but not because the human spirit was originally so formed by a Higher Power, but because the ceaseless interaction that has been kept up from time immemorial between the human mind and the external world has not had and could not have had any other result. Perhaps also the extension in space of our organ of thought, and the succession in time of brain-processes, are sufficient in themselves to explain this apparent innateness of the conceptions of time and space.*)

Another thing must also be noted, which reduces

*) The exact grounds for the above views may be found in the Author's already cited work, "Die Macht der Vererbung," pp. 91 *et seq.*

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to nothing the divine or supernatural, and therefore innate origin of ideas, as set forth by the ideal philosophers: If æsthetic, moral and metaphysical ideas were innate, direct and supernatural, it is obvious that they would have to shew a perfect similarity everywhere and under all circumstances; they would require to have an absolute value, and an absolute worth. But in reality we find that they are in the highest degree relative and changing, that they exhibit the greatest and widest divergencies at different times and among different nations and individuals — which divergencies are so great that the very opposite takes place.

As far as æsthetic conceptions are concerned, no stronger proof can be given of the unstable and changing, relative and undecided character of these than what is called *fashion*, which is often pleased with the most marvellous and repulsive things and not unfrequently with the most inconceivable monstrosities. The ideas of beauty are like the ideas of suitability. A thing appears suitable or beautiful to us, because we are accustomed to or acquainted with its existence or appearance, because it has become suited to our eye, or because the sensation of the eye-movement or eye-stimulus has gradually adapted itself to it. On the same ground, we should in all probability find it no less beautiful and suitable if it had gradually attained this agreement with our want or sensation under some very different shape. Therefore, as a rule, all those sights appear beautiful to man which most frequently come before him and excite his perceptive apparatus in an accustomed fashion, while all unaccustomed or anomalous impressions produce the contrary effect. Things which at other times and

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amongst other people aroused, or still arouse, the greatest admiration or delight, appear to us repulsive or revolting, while on the other hand we are charmed with that to which others are indifferent. Thus, classical antiquity, despite its high æsthetic culture, had scarcely a conception of the beauties of Nature which we admire so highly, and it mingled in its works of art human and animal forms in a manner that seems to us unbeautiful and undignified. Southern people admire only clear bright colors, because their eyes are accustomed to a brilliant light-stimulus, while Northern folk, less accustomed to this, give the preference to softer darker shades.

It is impossible, as Darwin very accurately remarks, that there should be in the human mind any general standard of beauty in relation to what lies immediately around us, or in relation to our own bodies, seeing that in this we meet the strangest varieties or antitheses. A Chinaman considers a woman charming who is as fat as possible, has stunted feet, oblique eyes and large ears, whereas all these things are to our taste repulsively ugly. The Japanese admire only a yellow skin and stain their teeth black, because to them it seems hideous to have white teeth like a dog; while our poets find nothing they praise more highly that the dazzling pearls of their fair ladies' teeth. The inhabitants of the island of Ceylon, by chewing betel-nut, have become so accustomed to the sight of black teeth, that white teeth appear ugly to them; and the long slightly curved noses of the Cinghalese met with so little favour in the eyes of the Chinese conquerors of their island, in comparison with their own flattened ones,

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as to make them send home an official report, saying that the dwellers in Ceylon were an ugly race, with beaks in their faces instead of noses. The Batokas of South Africa knock out the two upper incisors, when persons of either sex come to the age of puberty; in consequence of this the lower incisors grow to an unusual length, and the whole face acquires an unpleasant and aged appearance. Yet every girl who has not undergone this horrible operation considers herself as ugly. At all times and in all countries, generally speaking, people of the most diverse races and nations have endeavored to improve or beautify their bodies by disfiguring or cutting about different parts of it, so as suit the general or individual taste. Striking out or pulling out teeth or filing them short or to a point — the very teeth which are necessary for use and beauty and the loss of which is artificially repaired by civilised men — pulling out the hair of the head and beard, which we regard as the most beautiful ornament of a male or female head, or the eyebrows, without which we cannot imagine a handsome human face; piercing the nose, lips or ears, and putting in wooden plugs or other foreign bodies into the openings; bringing about artificial malformations of the skull; fancifully painting or pricking the skin in the most disgusting fashion — all these and similar arts are the practical results of the conception of beauty among most savage tribes, among whom, as Darwin remarks, the human face only appears to exist for the purpose of being changed and disfigured in the most variegated and extraordinary manner.*)

*) Further details will be found in Darwin's "Origin of Man."

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Lady Baker, the wife of Sir Samuel Baker, was advised by the wife of a chief in Latoaka to pull out the teeth of the lower jaw and to wear a long, pointed crystal in the underlip, in order, as she thought, to strikingly improve her appearance! A hollow or bowl-shaped ring, called the pelele, worn in the lower lip, gives a hideous appearance to the women of some South African negro tribes. Livingstone asked a chief what was the good of this custom. The chief, quite astonished at this question, replied: "For the sake of beauty, of course. That is the only beauty women have. Men have beards, women have not. Where would they be without pelele?"

This last anecdote reminds us of the pride taken by men of bearded races in their beards, while those of beardless races take the greatest pains to pull every single hair off their faces, as something decidedly repulsive. The beardless New Zealanders have a proverb that there is no wife for a hairy man, while the bearded Turks regard the beard as so important that they swear by that of their prophet. Our European women, too, no doubt regard a beard as beautiful; for they have a proverb that a kiss without a beard is like soup without salt. *Hearne*, a trustworthy observer, who lived for years among the North American Indians, says: "Ask a Northern Indian what constituted female beauty, and he will answer: 'A broad flat face, small eyes, high cheek-bones, three or four oblique black lines on each cheek, a low forehead, a large broad chin, a knotty hooked nose, a yellow brown skin, and breasts hanging down to the waist.'"

These examples of fundamental differences of

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æsthetic conceptions might easily be multiplied. If these conceptions have anything in common, it is due to the community of race, surroundings, and general conditions of life, and in a narrower sphere to the force of custom, of education, example and heredity. It may easily be shewn that no form of art has ever succeeded in creating an ideal, severed entirely from reality, and not having borrowed or rather gathered together the whole of its parts from the external world. The task of art is to unite the scattered lovelinesses of units into one harmonious, though but mentally conceived *ensemble*. For the rest it must not be forgotten that in the world of art and thought of each individual nation the influence of its own interior and exterior idiosyncrasy or peculiarity may readily be recognised.

In exactly the same way, *moral* conceptions are to be properly looked upon as the result of gradual learning and training. Nations in a state of Nature lack almost all moral qualities, and commit cruelties and follies of which civilised peoples have no conception; nay both friend and foe consider that such actions are the right thing. The moral conception of *property*, for instance, is as a rule either absent entirely, or present only in the most limited degree; hence the great tendency of all savage nations towards thieving. Among the *Indians*, a well executed theft is considered a most meritorious act; even the ancient *Lacedemonians* looked upon a theft carried out with great dexterity as worthy of the highest commendation. To the ever poor and hungry gipsies, larceny does not appear as a crime, but simply as a necessity. According to the Captain *Montravel's* report, the Kanaks

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of New Caledonia divide what they possess with every one who is in need, and are so ready to give away whatever they receive to the first-comer, that among them an object of great value often passes rapidly through a thousand hands. Even among nations of a higher degree of development the sense of property is often very weak, and with Chinese and Slavs scruples as to property are well known not to rank among points of honour.

What applies to theft, applies likewise to lying, cheating, murder and incest, which are customary and licit, nay even commended, among tribes in a state of nature and among half-civilised nations. Thus, with the aborigines of Further India, Dr. *J. Helfer* (Asiatische Reisen) tells us, it is a regularly followed maxim of wordly wisdom never to speak the truth, even when there is no occasion for lying; and according to the same author, this fault is shared in by almost all Asiatic nations. According to *Stone's* report (Journ. of the Anthrop. Instit.), love of truth and common honesty are quite unknown among the Motus, a race of New Guinea. They are inclined only to lying, cheating and stealing, and do not regard theft as a crime. The feeling of gratitude is unknown to them. They believe in no God and practise no religious observances. *Brehm* (Reiseskizzen aus Nordost-Afrika, 1855) relates that "the negroes of East Soudan (Nile-country) not only palliate cheating, theft and murder, but regard them as acts quite in keeping with man's dignity." Lying and deceit are regarded by them as a triumph of intellectual superiority over stupidity. The reports of the experienced African traveller *Burton* tell us even worse things of the negroes of Eastern Africa.

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Their reason is not like ours; it gropes without logic in nothing but contradictions. Compassion, uprightness, gratitude, prudence, family affection, modesty, conscientiousness, and remorse, are unknown things to the East African; he has no history, no traditions, no poetry, no morality, no imagination, no memory, no thought beyond the most limited range of mental perceptions, no idea of the great mysteries of life and death, no religion and no faith beyond the crudest fetishism. He knows of no grief nor mourning over the death of relatives, no attachment between parent and child; on the contrary, in his case, as among wild beasts, a natural hostility prevails between father and son. He murders, robs, steals, lies, gambles, drinks and begs, to almost any extent. Captain *Speke* relates of the Somalis the inhabitants of a district lying to the South of Aden, and separated from the Arabian coast by the gulf of Aden, that a successful fraud pleases them better than any other way of getting their livelihood, and that the enarration of such deeds is the chief topic of their social gatherings (Blackwood's Edinburgh Magazine). Among the Fiji Islanders the shedding of blood is a virtue and not a crime. Whoever the victim may be, whether man, woman or child, whether slain in battle or murdered by treachery, to be in any way a recognised murderer is the condition most eagerly coveted by every Fiji Islander! Children murder their parents, and parents their children without compunction. Gratitude is so little known to them that when the captain of a foreign ship had for two months nursed a native who had injured his hand on board of his ship, and had eventually cured him, this native being

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denied a gun for which he had asked on leaving, set fire to the captain's drying house, containing goods to the value of 300 dollars. Among the savages generally, murder is considered as quite worthy of commendation, and the more skulls of murdered men any one has to show, in whatever method he may have come by them, the more he is honoured. With them, to forgive an enemy is a great mistake; the highest virtue is revenge. In Hindustan there actually exists a terrible league of professional murderers, called *Thugs*, who practise secret murder as a religious rite.*)

Werner Munzinger (Ueber die Sitten und das Recht der Bogos, Winterthur) relates of the *Bogos*, a tribe of Northern Abyssinia, that among them the ideas of *good* and *evil* are perfectly confused and signify nothing more than useful and useless. *Virtuous* are to them the fearless, the avengers of blood, the silent ones who hide their hatred within themselves, until a good opportunity arises; the courteous, the proud, the indolent who despise menial work; the magnanimous, the hospitable, the ostentatious, the prudent. Robbery brings honor, larceny only is despised. In the same way *Waitz* relates (Anthropologie der Naturvölker, 1859) that such a savage, on being asked about the difference between good and evil, at first confessed his ignorance, but, after some reflection said that it was *good* when one took other people's wives, but *bad* when one's own were taken! A similar story is told by Sir *John Lubbock* of the natives of

*) It is related of such an Indian Thug that he felt *remorse*, because he had not strangled and robbed as many travellers as his father had done before him.

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Polynesia, who in their language are not able to express the moral difference between *good* and *bad.* Upon a missionary trying to make them understand that it was bad and wicked to consume their fellow-creatures, they answered with great composure: "But we assure thee that it is very good." Another savage, to whom a missionary was trying to convey the idea of the pangs of an evil conscience, could, according to *E. Tylor,* form a conception of it only by likening it to a severe stomach-ache. Up to this very day, the Albanians have no expression in their language for the ideas of good and bad.

According to the report of the Russian traveller *N. von Nicklucho-Maclay,* the savage Papuans in the interior of the Malay Peninsula have no idea of incest, and the fathers exercise the *jus primæ noctis* on their marriageable daughters — a custom prevalent also in other places, *e. g.* in the Eastern Moluccas. Among the Damaras, a South African tribe, who practise polygamy and have no idea of incest, Anderson found (Explor. in South-Western Africa, London, 1856) mother and daughter together in the harem of a chief. Unions by marriage between brothers and sixters are an abomination to us, but in antiquity, especially in Persia and Egypt, they were frequent and were thought quite honorable and commendable.

Suicide also was regarded among the ancients as an honorable death, worthy of a great and good man, whilst at the present day it is branded as a sin by the religious feeling of civilized nations.

Infanticide is rightly regarded by civilised nations as one of the most odious of crimes, and as an abominable sin. But it is a fact that almost all

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civilised nations went in former ages through a period in which it was regarded as perfectly natural and permissible. This was the case even down to Christian times, for infanticide was first prohibited by *Constantine* in the Roman Empire, throughout which it was quite general in the first century after Christ. Even at this very day, child-murder is a customary thing among almost all savage tribes, probably owing to the difficulty of procuring means of subsistence, or of conveying the children while migrating from place to place. It is a fact that custom and habit gradually stunt even the powerful feeling of motherly love to such an extent as to make mothers help to devour their own infants. Infanticide is most generally practised in the South Sea Islands, where two thirds of the infants born are killed, and half the unborn are destroyed by abortion. Babies at the breast are always killed at the mother's death, and buried with her. In Australia also, in Central Africa, in India, among the Indians of North America and among various nomadic tribes, such as the Kamtskatkans, infanticide is still practised, while in China the murder of female infants is chiefly common. Among many savages, especially the nomadic, those effete with old age, the same as children, are put to death and eaten. This, according to Captain *Wilkes'* report, is the principal reason why among the Fiji Islanders there are but few people living above the age of forty.*)

But not only among savages, but also among civilised nations, and among individuals belonging to

*) Compare the admirable paper on Infanticide as a national custom, by *C. Haberland*, in the "Globus," 1880, Nr. 25.

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such, are moral conceptions often undeveloped or contradictory to a remarkable extent. These conceptions vary very much and are mere questions of degree, or in other words, they depend in each instance on the actual circumstances of the case or on individual views. This is true in such a measure that it always seems an impossibility, and will continue to be impossible, to obtain anywhere an absolute and specific definition of what is meant by good.*) Thousands upon thousands of examples taken from daily life, may easily be quoted in support of this. If at the first blush there appears to be something constant and immutable in the principal laws of morality, the reason lies chiefly in the settled form of legal enactments and social customs which human society has thought necessary and has gradually established for its own preservation. But since the formation of human communities must, on the whole, have required the same conditions everywhere for its maintenance, it is not surprising that such enactments and customs should exhibit a certain similarity everywhere, which is to be accounted for by strictly natural facts. Nevertheless they vary a great deal individually according to changing external circumstances and according to the variations of times and opinions. The killing of an unborn fœtus did not appear to the Romans, as we have already remarked, as an action contrary to

*) That the conception of good cannot be defined is generally admitted. Theologians have thought that they could supply the definition in saying "That is good, which is enjoined by the commandments of God." But the commandments of God are, as a matter of course, made up by the theologians themselves. Any one can easily draw his own inference from this.

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good morals; at this day, on the contrary, it is severely punished, while the Chinese still practice infanticide and look upon it as the right thing. Paganism regarded the hatred of an enemy as the highest virtue; Christianity on the other hand demands love even for an enemy. Now which of the two things is moral? A number of things now branded by custom as abominable crimes were at one time thought perfectly proper. Training, teaching, example make us acquainted with these precepts day by day, and lead us on to believe in an *innate moral law* or "conscience," the component parts of which are found, on closer inspection, to be either sections of the criminal code, or incarnate expressions of the customs of social life. When a Mohammetan woman feels remorse for having unveiled her face, or a Hindu in supposing that he has eaten something unclean or lost caste, no one is likely to ascribe such a feeling to anything more than a social prejudice.*) At the

*) The innate moral law, or "conscience," or the "categorical imperative" as Kant calls it, is now relegated to the realm of fancies by most philosophers. *Schopenhauer* terms it an "infant-school morality." A characteristic item, accounting for the origin of it, is the observation made among savage races, that the moral precepts current among them are always limited to their own tribe and observed within it, because non-observance would endanger the existence of the tribe; whereas in dealing with a *strange* tribe every moral or rightful theory is cast aside, and every form of cruelty and license is not only allowed, but is actually enjoined. The conception of a common "humanity," or a human right prevalent throughout the race, is an achievement of civilised modern historical progress. But even at the present day, national antipathy or chauvinism breaks out anew, whenever opportunity offers, thus shewing that the race-hatred in man's heart, having, as it were, an atavistic tendency, is yet far from being

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same time, there is a great difference between the laws of the state and those of morality; a yet greater discrepancy exists between those of the State, of custom and of religion, and those prescribed to each individual in each special case by his own nature and reflexion. These differences afforded of yore the greatest tragic *motifs* both in history and poetry, and will continue to do so. The State and Society often brand as a crime what is morally a noble deed. The whole deep-seated difference between the ideas of "juridical" and "moral" springs but from outward conditions, which is the best proof of the fact that the idea of good has no absolute standard. Most crimes are committed by persons belonging to the lower classes, and are almost invariably the demonstrable results of bad training and education, or of an innate weakness of the intellectual faculties. The whole moral nature of man is most intimately connected with his outward conditions. The higher our degree of civilisation, the higher must also be the standard of morality and the greater the

extinguished, and only requires a spark to make it burst once more into flame. In reality, conscience and the moral sense are nothing more than the expression of social instincts that have grown strong by long habit, and depend on the knowledge of the laws of civilised social life and on custom. It is therefore not surprising that we sometimes find in degraded criminals, who have grown up in the midst of brutality and coarseness, an entire absence of remorse and of moral feeling. The moral law itself, however, rests neither on a contract, as jurists will have it, nor on an innate idea, as moralists contend, but it is a pure natural law, enacted, as it were, by the pressure of necessity, without which the existence of human society would be, and would ever have been, a matter of impossibility. Without morality no society, and without society no human being can be imagined.

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diminution of crime. And as regards such a thing as an *inborn idea of right*, the very notion of it is simply preposterous. "All jurists," says *Czolbe* (loc. cit.), "base right upon an empirical or effective contract between men, without which it is as inconceivable as the theorems of geometry are without the conceptions of lines, angles, figures or limited bodies." If there were really an *objective* right, would it be possible for a difference between *right* and *law* to exist?

The idea embodied in the word *true* owes its origin and gradual development in even a greater degree to the progress of science and of human knowledge, and so little can it lay claim to stability that men have all times been, and probably will always be found breaking each other's heads and necks over its correct interpretation. If, notwithstanding this, the laws of thought or logic exhibit a certain unchangeable necessity or stability, this proceeds from the causes given on p. 128, and also from the fact of the law of thought, like the moral law, having first arisen from a natural or organic evolution, and being a law of nature determined by the unchangeable laws of the Universe. Human reason, as we have shewn, is but the mirror that reflects the universe, and logic and mechanics are the same thing.

Thus the most exact of all sciences, *mathematics*, on the empiric or *a priori* character of which so much has been said and written, rests on purely objective conditions, without the existence of which the mathematical laws themselves would be impossible; for this reason most mathematicians are now of opinion that

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mathematics belong to the physical, and not to the philosophical or speculative sciences. The ideas of space, size, dimension, of height, breadth and depth are all taken from sensative experience and from observation, and would never have existed without. Numbers represent no absolute, but only relative ideas, which have no reality apart from the things denoted by them; they only represent the form under which we contemplate the reality. Therefore, a number *per se* and without reference to an object is a mere abstraction. The formation of the numerals, as we are taught by etymological records, did not take place till very late, and seems to have cost a great deal of labour to each of the nations. To this day there exist many savage races who are very backward in this respect, and to whom the expression of large numbers is a total impossibility. The savage negroes of Surinam cannot count beyond *twenty*, and in doing so, they take their fingers and toes as symbols, and use even the names of these to designate the figures. Whatever exceeds the twenty fingers and toes they do not know how to count, and therefore call it "wiri-wiri," which means: much. According to Sir *John Lubbock* (Prehistoric Man, vol. II, p. 272 of the German translation), no Australian language has words beyond the number *four;* the Damaras and Abepoinas count only up to three; some Brazilian tribes no further than *two*. Whatever exceeds three, the Abepoinas call "Pop," or much. Many American and African tribes, according to *Tylor*, denote the number *five* by the expression "a whole hand"; for *six* they say, "one of the other hand"; for *ten*, "both hands"; for *eleven*, "one of the foot"; for *twenty*, "an Indian"; for *one-and-twenty*, "one of the

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hand of another Indian"; and more briefly, for eleven, "foot one"; for twelve, "foot two"; for twenty, "the whole person," or "a man." The number one hundred is designated as "five men." The *Arfakis* of New Guinea, as Dr. *A. E. Meyer* was able to prove conclusively, can only count accurately up to *five*, and have a definite expression for this number only. In counting from five to ten they are apt to blunder; but the use of their fingers helps them out of the difficulty. They express twenty by holding out fingers and toes together, and beyond this their notions of numbers do not extend. Yet they are in other respects by no means unintelligent.

Many savage tribes entirely lack expressions for general notions, or properties, which are common to different bodies, as "color," "tone," "tree," etc.; they have a separate word for each kind of color and each kind of tree, but no general expression. According to the Catholic missionary Father *Baegert*, who lived for a long time among the natives of Lower California, these people have no words for general notions or abstractions, such as life, death, weather, heat, cold, friendship, truth, illness, master, servant, judgment, rich, poor, pious, old, young, etc; they have only expressions for material things, which can be seen or felt, or for individual persons, such as a young woman, an old man, etc. (Rep. of the Smithson Institute, 1864, p. 394.)

Above all, there is no such thing as metaphysical or transcendental knowledge, properly speaking, and all systems of methaphysics, however ingeniously devised, have broken down in course of time. "Metaphysics," says *A. Leferre* very strikingly, "rise above

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that which is, in order to attain that which is not." All philosophical reasonings which leave the ground of facts and objects, soon become incomprehensible and untenable, and are mostly arbitrary and subjective radiations of a judgment formerly obtained empirically; they are a fantastic play upon words and notions. Let any one try if he can to conceive of himself a general notion or so-called abstraction, without necessarily falling back on external objects as examples! "Even the highest ideas," says *Virchow*, (Die Einheits-Bestrebungen in der wissenschaftlichen Medicin, neue Ausgabe, 1855), "are evolved slowly and gradually from the increasing wealth of sensative experience, and their truth is only guaranteed by the possibility of bringing forward concrete examples of them in the real world."

As to the often repeated assertion of the sudden appearance of general notions in childhood, it must be wholly denied that such an appearance ever takes place under circumstances in which the influences of education, surroundings, example, etc. are entirely missing. The sense of justice can only develop in a boy when association with others enables him to institute comparisons and to grasp the limits of the various spheres of the rights of others, while the absence of such conditions as a rule produces selfishness, arrogance and impatience. Not until after a tolerably advanced age has been reached does Society recognise personal responsibility — and this proves clearly enough that no innate idea of right is admitted to exist in the child. Neither do the moral or æsthetic ideas of a child shew the least trace of an innate perception. On the contrary, children often have very

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odd, and to adults ludicrous tastes. They do not distinguish, or distinguish only with difficulty, between *meum* and *tuum:* they have no conception of the wrongfulness of lying and stealing; they are great egotists; they shew clear tendencies in the direction of fraud and cruelty, thus resembling in many respects savage nations, which, from want of education and training, are very much like big children. This resemblance is most striking, owing to the absence of a psychical quality which, among civilised nations, shews itself powerfully but at the age of puberty, viz. that of *modesty:* in this respect there is no doubt that inherited tendency or disposition comes into play in the case of civilized races. On the other hand, if we are to believe the reports of *Dülfok, Orton, Schiele* and others, an entire absence of modesty is found among the Australians, Melanese, South Africans, Andaman Islanders, etc. Some go about perfectly naked, or only cover their sexual organs to defend them against external injury, and carry on sexual intercourse publicly, like animals. The sculptures on ancient Indian temples prove, as *Lubbock* remarks, (Prehistoric Man, vol. II, p. 262) that a nation may rise to a state of considerable culture, without recognising the slightest necessity for clothing: and even at the present day, the ideas of decency and modesty prevalent in India and in the Island of Ceylon are as wide apart from ours as are the two poles from one another.*) Even the ancient Greeks, the classic models of our higher education, had scarcely

*) See the interesting writings of A. Jacoillot: "Voyage au pays des Bajadères," and "Voyage an pays des perles."

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a conception of what we now understand by modesty and propriety in connection with sexual relations. Adultery and every form of promiscuous intercourse were quite customary among them, and were practised without the least fear of blame or publicity, while in their theatres the grossest obscenities were shewn on the stage. The *Ishmaelites*, an Oriental religious sect, are perfectly destitute of any feeling of modesty; atrocious beliefs and extraordinarily cynical customs are the chief features of the Ishmaelitish form of worship. The conceptions of decency and propriety current among the *Japanese*, a people far advanced in civilisation, differ so fundamentally from our own, and appear so indecent to us, that it is impossible to draw any parallel between their notions and ours. What we contemptuously designate by "prostitution" is in Japan the usual custom, and is ordered and regulated by the laws and under the superintendence of the state; and this view, so strange to us, extends to the whole public and private life. Secret non-licensed prostitution alone is not countenanced. "It is difficult," says *Reinhold* very strikingly, "to find any explanation of this difference, if we do not admit that morality is a mere *relative* idea." He who maintains, as *Liebig* does, that "the moral nature of man remains eternally the same," can have no conception of the almost innumerable facts connected with this which go to prove the very opposite.

Although the sense of truth, of beauty, and of right, must to a certain extent be aroused by the influence of the surroundings in every fairly educated person, that lives under normal social conditions, it

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can and must yet be carried into practice in order to attain strength and value. How differently does a learned man, accustomed to think and enlightened by reason, think and argue, from one who devotes his whole energy to manual labour only? How very differently does the man trained in life and in the school of history enter the lists for right and justice, from the unfledged youth, who still follows mere purblind inward impulses! How differently do the artist and the outsider judge of beauty! As a plant takes its root in the soil, so do we, along with our knowledge, thought and feeling, take root in the objective world, bearing aloft the blossom of the ideal; but, when snatched away from that soil, we must, like the plant, wither and die.

The inference we derive from all this and which stands in the closest connection with it, is that we can have no knowledge and no idea of the *Absolute*, that is to say of anything which is beyond the sensational world around us. Let the metaphysicians seek, as they may, to define the absolute; let religion endeavour, as it may, to arouse belief in the absolute by the theory of direct revelation — nothing can hide this internal defect. All our knowledge and perception is but relative and arises only from an antithetical comparison of the sensational things surrounding us. We have no conception of darkness without light; none of high without low, of heat without cold; absolute ideas we possess none. We are not able to conceive otherwise than vaguely, an idea of "everlasting" or "endless," because our reason, limited sensationally by time and space, finds in these words an insuperable boundary to that idea. Since we are

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accustomed in the sensational world to find a cause wherever we meet an effect, we have erroneously hit upon the existence of a First Cause for all things, although no such cause is perceptible to the range of our present faculties and although it is at war with scientific experience. "In countless groups of natural phenomena," says *Czolbe* (*loc. cit.*) "it is certain that they originate in, or are the effects of causes. From this springs the mistaken inference that Nature itself, or the Universe, has a primary cause. But there is not only no experimental ground for the idea that Matter and Space have originated and can be changed and destroyed, but not even a conception can be formed of this. We must therefore look upon Matter and Space as co-eternal."

From all this it appears that there are to be found in no direction clear scientific facts which compel us to believe in the existence of innate ideas, conceptions, views, knowledge, or thoughts, implanted in our minds from without by a higher power. Nature knows neither views nor objects, neither psychical nor material conditions imposed upon her from without or from above. From the beginning to the end she has evolved organically out of herself, and keeps evolving without ceasing. We close this chapter with the words of *Moleschott* which every one ought to lay to heart: — "In the school instruction on thought, sharp boys are often much hampered in their intellectual progress, because the instructors won't teach them to form their judgment, conception and inferences from plain existing facts. Despite the utter failure to which they lay themselves open, they continue

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seeking to impart to their scholar the notion that he must withdraw his eyes from the green tree, and must turn his thoughts from matter, in order to attain to regular abstract ideas, *with which the tortured brain moves in a world of shadows.*"

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THE IDEA OF GOD.

God is a blank tablet, on which there is nothing save that which thou thyself hast written.

Luther.

God is a thing intangible, that has no connection with time or space. The more thou graspest at him, the more he escapes thee.

Angelus Silesius (1624—1677).

Man paints himself in his gods.

Schiller.

Whenever knowledge takes a step forward, God recedes a step backwards.

Naquet.

If it is true that there are no such things as innate views or ideas, it stands to reason that the contention of those must be mistaken who assert that the *idea of God,* or conception of a supreme *personal* being who has created the world and who rules and maintains it, is naturally innate, necessary or instinctive in the human mind, and therefore irrefutable by any arguments drawn from reason. If we believe the adherents of this view, it is proved by experience that there are no nations nor individuals, however savage or uneducated, in whom there is not found the idea of God and the belief in a supreme personal being, and that this universal *consensus gentium*

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is the best proof of the truth and accuracy of the said idea itself. As a matter of fact the exact opposite is proved by an intimate knowledge and unprejudiced observation both of individuals and of nations in a savage and undeveloped condition; for, according to the unanimous testimony of traders, philosophers, navigators and missionaries, there exists a by no means small number of peoples, who have either no trace of religious belief, or who have it in so strange and imperfect a form that it scarcely deserves the name of religion. If there are, therefore, many philosophers and naturalists who look to "religiosity," and more particularly to the idea of God as the distinctive feature of humanity, the contention referred to must either be false, or we must make up our minds to deny human character to by no means a small number of actual and undoubted specimens of mankind.

"I cannot entertain the slightest doubt in my mind," says the famous anthropologist *Broca*, "that there are among the lower races people without worship, without dogmas, without metaphysical conceptions, without general creeds, and consequently without religion." The traveller *de Lauture* writes: "It is a remarkable error to suppose that all nations believe in a God; I have found many savages who had no such idea." Sir *John Lubbock* (Prehistoric Time, vol. II, p. 277) says: "Those who hold that even the lowest savages believe in a supernatural being, are maintaining a theory which is in most complete conflict with fact"; and Darwin (Descent of Man, p. 93) writes: "There is ample evidence, adduced not by mere visitors, but by men who have long resided among

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savages, that numerous races have existed, and still exist, which have no idea of one or more Gods, and which have no words in their languages to express such an idea."

Darwin himself (ibidem p. 95) states that in his famous voyage on board the *Beagle*, he as well as his companions found that the Fuegans (who inhabit the archipelago at the extreme south of the American continent) believed in nothing which we should call God, nor practised any kind of religious worship. According to *R. Elcho* (Westermann's Monatshefte, July, 1881, and a report in the journal, "Globus," vol. XXIX, Nr. 21), the *Californian Indians* generally have no idea or conception of a supreme or supernatural being, or of a world-preserving and world-governing power. Some tribes hold that death is the end of everything, while others dream of a better life in a land lying west. When they speak of a "great Man," or of an "old Man above," or the like, this is only a modern form in which their ancient views are couched; for this being never plays any part in their affairs, nor appears in their popular mythology; it creates nothing and preserves nothing. Nature is their only God, and her servant is the *coyote*, a kind of dog or jackal, who, in their theory, made the world and all that therein is. Father *Baegert*, who spent seven years as a missionary among the Californian Indians, states that idols, temples, religious ceremonies, or divine service, are perfectly unknown among them, and that they neither believe in the one true God, nor worship false Gods. (Smithson. Contrib. 1863—64, p. 390). The same or similar statements are made by *de la Pérouse*, *Colden*, and *Hearne*.

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with respect to different tribes of American Indians (compare *Lubbock*, *loc. cit.* vol. II, p. 274). The famous English traveller *Bates*, too ("The Naturalist on the Amazon," London, 1863), relates of the otherwise more polished *Brazilian Indians* on the banks of the Tapajos and Cupari: "They have neither an idea nor a conception of a supreme being, and do not trouble themselves about the causes of the natural phenomena surrounding them. They only know one sort of evil cobold, who is the cause of their misfortunes." Nor have any of the Indian tribes dwelling on the banks of the Upper Amazon any word in their language to express the idea of God; and the Caishanas Indians who dwell in the same district, do not even practice the ceremonies in honor of the evil demon usual among the other tribes. The same holds good for many of the South American tribes, visited by *Azara* (Voyages dans l'Amer. merid., vol. II, p. 3—166). Father *Dobritzhoffer* relates of the nation of the *Abepoinas*, that to his great surprise he did not find in the language of these savages a single word which signified God, or a divine being (quoted by Lubbock, vol. II, p. 276). Of the Indian tribes of the *Payaguas*, living on the Paraguay, near Asuncion, *M. A. Baguet* reports (Bull. de la Soc. Geogr. d'Anvers, 1878, vol. II, p. 63), that they have no idea of a higher being, and that all the attempts of the Jesuits to convert them have egregiously failed. According to Lubbock (p. 273) it is stated in the missionary reports on the South American Indians of Gran-Chaco, that they "have no religion, perform no divine service, and do not possess the smallest idea of God or of a supreme being. They do not distinguish between right and

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wrong; they have no hope of present or future rewards, and no fear of punishment, nor secret dread of a supernatural power, which they can propitiate by offerings or idolatry."

Africa, the dark quarter of the globe, yields examples equally striking of a total absence of religion and belief in God. Among the negroes of *Ouka-nyama*, one of the many stations of South Africa, *Ladislas Magyar* could find no trace of any religion. They appear to reverence their king or chief as the supreme being, and seek to propitiate him by human or animal sacrifices. The *Lakutas*, who inhabit the district of the sources of the Nile, were found by *S. W. Baker* (The Albert-Nyanza, 1867), to be without any trace of a religion or belief in God; even the fetishism so common among negroes was perfectly unknown to them. According to the reports of the celebrated *Livingstone*, the *Betjuanas*, or *Bechuanas*, one of the most intelligent tribes of Inner Africa, as well as all the mid-African tribes, have no trace of worship, no kind of idols, and no single religious idea (Bull. de la Soc. d'Anthrop. de Paris, 1864, p. 227). *Andersson* (Travels in South Africa, London, 1856) reports similarly that the language of the Bechuanas lacks a word for the conception of a Creator; and the missionary *Moffat* relates of them in his characteristic way: "I have often wished to find something whereby I might reach the natives' hearts; I have sought among them for 'an altar to the unknown God', for some hint on the creed of their ancestors, of the immortality of the soul, or any other religious idea. But they have never thought of anything of the kind. When I spoke to the best among them of a Creator,

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who ruled heaven and earth, of the fall of man and the redemption of the world, of the resurrection of the dead and of everlasting life, it appeared to them that I was talking about things that were more fabulous, absurd and ludicrous than their nonsensical stories of lions, hyenas and jackals. When I told them that it was necessary to know and believe such and such teachings of religion, I drew from them nothing but shouts of the greated astonishment, just as though it were too foolish for even the most stupid people to listen to it." Of the *Kaffirs,* a race known to be well-developed, both physically and mentally, *Oppermann* says: "They have not the most remote conception of a supreme being; their chief is their God." The harmless race of *Hottentots* believe in a good and a bad spirit, but know neither temple nor divine service, except some festive dances in honor of the full moon, and the veneration for a little shining beetle, which is almost regarded as a God. *Le Vaillant,* who lived a length of time with them, says that he found among them no trace of religion nor of belief in God (*Voyages dans l'Afrique,* vol. I, p. 93). The *Bushmen,* a dwarfish species of these, know of no kind of divine worship. In the rolling of the thunder they think they descry the voices of evil spirits, and they answer with curses and oaths. According to *Gustav Fritsch* (Die Eingebornen Südafrika's, Breslau, 1872) the *Ovaherero* or Vieh-Damaras of South Africa have no religion, but only external superstitious customs, connected with witchcraft, amulets, spirits of animals, veneration of trees, and the like. *Burton* (Trans. Ethnol. Soc. New Ser., vol. I, p. 323) says of some of the tribes living around the lakes of Central Africa,

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that they "believe neither in God, nor in angels, nor in devils."

If we glance at Australia and at the islands of the South Sea and the Pacific Ocean, we find the following: "*The native Australians*," says *Hasskarl* (Australien und seine Colonien, 1849), "lack the idea of a Creator, or a moral Governor of the world, and all attempts at instructing them on this point result in non-comprehension, or in a sudden breaking off of the conversation." The French castaway, *Narcisse Pelletier*, who lived *seventeen* years among these savages at Red Rock Point, to the south of Cape Direction, relates that they have no idea of a supreme being and no kind of religious ceremonies. *Latham* says of the Australians that they have not yet succeeded in forming even the roughest outlines of a religion, and that their mind seems too indolent even to be superstitious. "What can be done with a people," a missionary remarks about them, "whose language has no words for 'justice', 'sin' and the like, and to whose mind the ideas expressed by these words are wholly foreign and incomprehensible? Sir *M. Bradley* says of an Australian tribe: "The monosyllabic language of these savages consists of more or less animal sounds. They have no sort of superstitious ideas, and do not shew the slightest trace of a belief in a future life" (Revue scient. 1873, p. 473). The *Motus* of New Guinea, according to the report in the Journal of the Anthropological Institute, believe in no God, and practise no religious rites. The spirits of the dead, they believe, go to "Taulu," a word which apparently signifies empty space. In the Damood Island, between Australia and New Guinea,

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Jukes found (Voyage of the Fly, I, p. 164), "no trace of religious belief nor of divine worship." The *Samoan* Islanders have neither temples, nor altars, nor sacrifices (Mission. Enterpr., p. 464). Dr. *Monnat* says of the *Mincopis*, the inhabitants of the Andaman Islands: "They smear themselves with clay and paint, but wear no clothes. They seem in fact to be devoid of all modesty, and resemble wild animals in their habits. They have no idea of a Supreme Being, no religion, no belief in a future state" (Trans. Ethnol. Soc., II, p. 45). The inhabitants of *New Britannia* (Melanesia) in the Pacific are, according to Dr. *O. Finsch* (Gartenlaube, 1882, p. 606), very good-natured indeed, but they have no trace of a religion or of any kind of worship; the belief in the existence of man after death is also quite unknown to them. The *Negritos*, or black aborigines of the Philippine and Molucca Archipelago, have, according to Dr. *Th. Mundt-Lauff* of London, no kind of religion, beyond slight traces of fire and sun-worship; they have neither idols nor temples. Corpses are turned with their faces towards the sun.

Similar phenomena are found even in the ancient cradle of civilization, Asia; several famous and widespread religious systems have arisen here, in which belief in God, or the idea of God, is utterly unknown. An English officer reports that the *Karens* of the kingdom of *Pegu* (India) believe in no God, and only recognise the action of two evil spirits. The inhabitants of *Pasummah Labar*, in the island of *Sumatra*, pray to no idols nor to any other external object; they have no priestly caste, and no idea of a Supreme Being who created all things.

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The British Colonel *Dalton* relates of the *Dschuangas*, a primitive savage race of India, who regard themselves as the direct descendants of the first man, that they do not believe in witchcraft; their language has no expression for God, heaven or hell, and so far as is known, they have no conception of a future state. In misfortune they offer fowls to the sun and the earth, that they may obtain a good harvest; beyond this there is no trace of any kind of worship. The *Khasias*, or Khasiates, also an Indian tribe, content themselves under such circumstances with the breaking of hens' eggs; beyond this they have no religion, so Dr. *Hooker* (quoted by *Lubbock*, Prehistoric Man, vol. II, p. 227) tells us. Of the happy dwellers in the Liu-Kiu island of *Amami Oshima*, near Japan, Dr. *Döderlein*, who stayed there sixteen days, and who wrote on them in the "Mittheil. der deutschen Gesellschaft für Natur- und Völkerkunde Ost-Asiens" — informs us that they have neither God nor Gods, nor prayers, nor temples, nor priests. The only objects of their religious reverence are their ancestors. Perhaps this worship, Dr. Döderlein considers, represents the original form of the Japanese Sintho or Sintu religion, which is no longer to be found in Japan itself. The *Japanese*, a nation of thirty-four millions, who, according to the testimony of all travellers, stand very high in morality and in social and political customs, believe neither in God nor in immortality; they are, to use the expression of *Burrows*, the American traveller, "a nation of atheists," or, according to others, a race of sceptics or materialists. Yet *Alcock*, the English traveller, asserts that national education has made greater strides

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among no race on earth than it has among the Japanese.

In connection with the atheistic religious systems of Asia, we must note that the famous religion of *Buddha*, which will be more fully dealt with in a subsequent chapter, knows nothing of God or of the immortality of the soul, and preaches non-existence as the highest goal of freedom. Equally atheistic with Buddhism are the two religious systems of the *Chinese*, so that, according to *Schopenhauer* (Ueber die vierfache Wurzel des Satzes vom zureichenden Grunde, 2rd ed., 1847) the Chinese language has no word for "God" and "creation." According to the reports of travellers, an entire moiety of the Chinese population, indeed the more cultured and educated moiety, consists at this day purely and simply of atheists, and practises no religious worship of any kind. In the whole of Sanskrit, too, the original language of the pantheistic Aryans, there is no vocable which signifies to "create" in the Christian sense of the word. Altogether, Schopenhauer holds that the idea and revelation of a personal God originated in but one nation, viz., the *Jews*, being subsequently propagated in the two religious systems which proceed from Judaism, viz., Christianity and Mahommetanism.

Even *Europe* is not entirely without godless races. In the course of the last journey which the Emperor of Austria made through his dominions, he came, so the newspapers state, to a town named Kolomea in Galicia, in the neighbourhood of which lives a fine, well-knit race, called the *Huzules*. Although they are good-natured people enough, they have scarcely

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any religion, and within a circle many miles in diameter, no churches are to be seen. Once a year only, the "pope," whom they scarcely know, rides through the towns and baptises the ne-wborn children. Yet these people live well and peacefully, they die without the consolations of the church, and go to heaven, if there is one, just as well as those who go to confession four times a year. The *gipsies* also, who are scattered over Europe and over half the world, are, according to the close investigations of *G. Leland* (The English Gipsies and their language, London, 1873), absolute atheists, and have no trace of religious belief, although they have lived for hundreds of years among nations with religious creeds.*)

We find the same absence of religious conceptions, in our sense of the word, as among the nations above-named, so within our own midst, in individuals who, by education, teaching, or example, have had no opportunity of becoming aware of the idea of God. We frequently read of men appearing in the police-courts of great cities, such as Paris and London, who have not the least idea of the conceptions implied by the words God, immortality, religion, etc. The British census has shewn that there are millions of people living in England who have never crossed the threshold of a church, and who do not know to what sect or religious creed they belong.**) The blind deaf-

*) Sir *John Lubbock* has collected a number of additional well-ascertained examples of tribes absolutely without religion. See his "Prehistoric Time" etc. See also the Rev. *F. W. Farrar's* Essay on the Universality of Belief in God and Immortality, in the Anthropol. Review, London, 1864, August, p. CCXVII *et seq.*

**) At the present time there are in England a million persons

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mute *Edward Meystre,* of whom *Hirzel* gives a full account, had no idea of God, and could not be brought to form such an idea, despite every effort that was made, and although he had very good intellectual abilities. The same was the case with the famous blind deaf-mute *Laura Bridgeman,* on whom her governess *M. S. Lamson* published a circumstantial report (London, Trübner, 1878), and with a second blind deaf-mute, named in the same work, called *Julia Brace.**) We referred in a former chapter to the animal and irrational nature of such human beings, who have remained without intercourse with their fellow-creatures, and lack every higher intellectual quality. If Nature is not able to make herself felt with greater power, without teaching and training, it must be assumed that she knows nothing at all of any such innate ideas bespeaking a supernatural origin. All these ideas are implanted by education; they proceed from the reflexion of others or of ourselves, and are not innate.

Anyone who, regardless of all this, persists in contending that the idea of God is innate, cannot but be led to the conclusion that we are likewise born with a belief in the devil, or the idea of an *evil* spirit endowed with supreme power, devil, Satan. one or more demons or whatever else it may be called. For it is in evidence that the belief in supernatural powers hostile to man has held in all ages and among all peoples, a sway of scarcely less, and among savages one of far greater extension and importance than the

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who are unbaptised and who belong to no church. "What can you tell me of Jesus Christ," said a clergyman to a man in a street of London. "Never heard of the gentleman," was the answer.

*) See the Revue Philos. 1879, Nr. 3, pp. 316 *et seq.*

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belief in a beneficent God. "The belief in such terrible and malevolent spirits," says Darwin, (Descent of Man, p. 95), "is far more universal than that in a good God." There are many savage tribes which only honor evil spirits, and sacrifice to them in order to win their favor, while they are indifferent to the good spirits.*) Belief in devils also forms an essential part of the Christian religion, and very properly too, for without him the presence of evil in the world would be perfectly inexplicable from the Christian point of view; it is an inevitable consequence of thorough belief in God.**)

No one has demonstrated and explained the purely human origin of the idea of God better than *Ludwig Feuerbach.* He calls all representations of God and of the Divine existence *Anthropomorphisms,* that is to say, the productions of human fancy and human theories, coined on the model of the human individuality, and he seeks the origin of this anthropomorphism in the feeling of dependence and slavish-

*) The Negroes of Gaboon (South Africa) honor the evil spirit *Mbuiri*, who is, in their opinion, the ruler of this world; they seek to turn away his wrath, while they do not trouble themselves much about the good *Ndschambi.* The inhabitants of Madagascar only worship the evil spirit *Niang;* they are indifferent to their good God, *Zamhor.* The Patagonians pray only to a devilish being, named *Qualitschu,* and the same is true of many other savage tribes. The theocracy of the Congo Negroes is entirely based on the worship of the snake which is the symbol of the devil. Thus the ancient Egyptians paid divine honours to the crocodile, also as a symbol of the devil.

**) For furthern information on this, and on the idea of God generally, see the Author's pamphlet, "Der Gottesbegriff und dessen Bedeutung in der Gegenwart" (Leipzig, 1874), 2rd ed.

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ness, which belongs to human nature. "A God existing independent of and above man," says Feuerbach, "is nothing more than the external and supernatural Ego, freed from its limitations, and considered objectively by the subjective human mind." "God is the self-consciousness of man. Man created God in his own image." The history of every nation is an unbroken chain of evidence for this contention, and how could it be otherwise? Without knowledge or conception of the Absolute, without a direct revelation — the existence of which is alleged, but not proved, by all religious sects — all representations of God, of whatever religion, could but be *human;* and since man finds in animated nature no higher intellectual being than himself, his ideas of a Supreme Being could only be abstracted from his own Ipse; they must be a *self-idealisation.* Therefore do we find reflected in the religious ideas of every nation, most faithfully and characteristically, the conditions, wishes, hopes, nay even the intellectual development and special intellectual tendency that obtained among that nation at the time; and we are wont to judge of the intellectual individuality and degree of culture of a nation by its religion. Take, for example, the poetical heaven of the *Greeks,* peopled with ideal artistic forms, in which the Gods, flourishing in eternal youth and beauty, enjoyed, laughed, fought, and intrigued like *men,* and found the peculiar charm of their existence in a personal interference in *human* affairs — that heaven into which *Schiller* breathed life in his exquisite poem on the Gods of Greece. Or take the wrathful gloomy Jahu or Jehovah of the *Jews,* who punishes to the third and fourth generation; or the

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Christian heaven, in which God shares his infinite power with his son, and ranges the celestial orders of the blessed quite in a human fashion; or the heaven of the Catholics, in which the Virgin Mary, in the bosom of the Saviour, uses her soft womanly power of persuasion in favour of the sinners; or the heaven of the *Orientals,* in which crowds of blooming houris, plashing cascades, eternal coolness and eternal sensual enjoyment are promised; or the heaven of the *Greenlanders,* in which their greatest wish is expressed in the rich superabundance of blubber, fish and seals; or the heaven of the sporting *Indians,* in which an eternal successful hunt rewards the blessed; or that of the *New Caledonians,* who hope to fill their future life with the eating of ripe bananas and with similar pleasures; or the heaven of the *Teutons,* who dreamed of drinking mead in Walhalla out of the skulls of their defeated foes; and so on.

Nay, more than this. Each individual person really pictures his own God according to the standard of his own special and personal idiosyncrasy. "Every one," says the priest *Meslier* in his famous "Testament," in which he so ruthlessly tears the mask off the faces of the bigots and believers in God, "makes his own God in his own way. Your cheerful man cannot believe that God could ever be severe and morose; the stern, irascible individual requires a God of terror, and looks on all those as heretics who believe in a gentle and indulgent one."

Feuerbach also clearly shews the purely human character of the idea of God as seen in the fashion of religious *worship* and the outward form of reverence to God. The Greek offered meat and wine to

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his Gods; the Negro spits chewed food into his idol's face as an offering; the Ostiac smears his Gods with blood and fat, and stops up their nostrils with snuff: the Christian, the Mahometan, the Jew, and the Indian think they can propitiate their God by personal entreaties and by prayers, and that they can even influence his actions. Everywhere human weakness, human sorrows, human desire for happiness! All nations and religions share in the habit of placing remarkable men among the Gods or the Saints — a striking proof of the human substratum of the idea of God! How ingenious and true is Feuerbach's remark, that the cultured man is a very much more refined being than the God of the savage, that God whose intellectual and physical nature must naturally be exactly proportionate to the stage of civilisation of his worshippers. This necessary connection between the human and the divine, and the dependence of the latter on the former, must have occurred with overwhelming clearness to *Luther*, when he said: "If God sat alone in heaven like a log, he would not be God." The Greek philosopher Xenophanes of Kolophon (572 B. C.) argued against the superstition of his countrymen as follows: "It appears to mortals that the Gods are like them in form, apparel and language. The negroes serve black Gods with flat noses, the Thracians Gods with blue eyes and red hair. If the oxen and lions had hands to fashion images, they would give the Gods a bovine or leonine shape."

The influence of Nature and of the surroundings may also be easily recognised in the ideas that various nations form of the Deity. The exuberant fancy of

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the Hindus, who live in a land full of tropical wonders and terrors, and who suffer from oriental tyranny, represents their God *Siva* as a terrible three-eyed monster, wrapped in snakes, clothed in a tiger-skin, holding in his hand a human skull, wearing a necklace of human bones, and raging like mad. His equally terrible wife Doorga or Kali has a darkblue skin; but the palms of her hands are red, to denote her insatiable blood-thirstiness. She has four arms, one of which carries the skull of a giant; her tongue projects far from her mouth; round her body and neck are suspended the heads and hands of her human victims.

If constrained human reason has not been able to divest the idea of God of its anthropomorphic character, or to attain a pure abstract idea of the Absolute, the reason of philosophers has been, if anything, even less successful in this respect. If anyone would take the trouble to collect all the philosophic definitions that have been offered of God, the Absolute, the Spirit of the Universe, the Universal Spirit, the pure essence, or the so-called soul of the world, he would get at an awful jumble in which, from the beginning of historical times down to this day, nothing new and nothing better has been brought to light, despite the alleged progress of philosophic science. No doubt there would be no lack of fine words and resonant phrases, but these cannot make up for the want of internal truth. "Have we," asked *Cxolbe*, "got one step more ahead in the knowledge of the still accepted ideas of things supersensual than we were thousands of years ago? What else do we possess of it now but mere words and names devoid

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of meaning?" "It follows," says *Virchow*, "that man can conceive nothing outside himself, and that everything lying beyond himself is transcendental, as far as he is concerned."

There are philosophers who imagine that they can get out of all difficulties by unifying the notions of "God" and "Universe," and who hold that God is neither without nor above the world, but is himself within it, that he has, as it were, changed himself into the universe and has thereby imparted to it all the perfections of his own essence. Thus, the philosophical naturalist *Fechner* says in his Zend-Avesta: "God, the aggregation of being and action, has no universe external to himself and no existence external and opposite to himself; he is the One and the All; all spirits move within his spirit, and all bodies within his body; he rotates wholly within himself, and is influenced by nothing from without; nay he is influenced wholly by himself, and in himself, since he embraces the basis of the influence of all existence within himself."

That sounds very beautiful, but nevertheless, if we look at it more closely, we find that is stupendous nonsense. If all spirits move within the spirit, and all bodies within the body of God, if there be no external universe outside himself, how can he still be God? Would he not in that case rather represent the substance of all corporeal and spiritual existence, or the sum total of the universe, which has been personified by the definers, whereas the universe in its endless extent and multifariousness is the negation of every personification! Well may Schopenhauer remark, as against the Pantheistic theory: "A God who

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has allowed himself to be changed into such a bad or imperfect world, must verily have been plagued by the devil!" If God is in us all and is the soul of the world, then he must directly partake of all our wickednesses and imperfections. He suffers in us toothache and bodily pain; he denies or insults himself in the mouth of one, while he reveres and worships himself in the mouth of another. In one man he does good, while in another he works evil and contends against his own laws. He worries himself with insoluble riddles, he dies in each individual in doubt and pain, he rewards or punishes himself in a future life, and so on.

But enough of all this nonsense! The Pantheistic or universal God is not one hair's breadth better than the personal God of the Theist. Neither is he a modern discovery. But our modern philosophers love to season old dishes with new sauces, and to serve them up as the latest *chefs d'œuvre* of the philosophic *cuisine.**)

*) Consult on Theism, Pantheism and Atheism, and the questions connected with them, the already cited pamphlet of the Author on the Idea of God.

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PERSONAL CONTINUANCE.

From the moment of death onwards, both the soul and the body feel as little as they did before birth.

Pliny.

— Thy best of rest is sleep,
And that thou of provok'st, yet grosly fear'st
Thy death, which is no more.

Shakspere.

Memento quod pulvis es et in pulverem reverteris.
(Remember that thou art dust, and shall return do dust.)

Man's body is dust,
But his soul lives in his works.

R. Voss.

In an earlier chapter we shewed by what we consider as irrefutable facts that what is called soul or spirit, stands in an indissoluble relation to its corporeal substratum, especially to the brain; we have seen that psychical phenomena arise, grow, decrease and become diseased with this substratum. Even though we may not be in a position to distinctly shew the internal connection of this state of things, or to say how and in what way psychical action is rendered possible by material combinations and activities, we yet find that these facts force upon us the conclusion that the connection is such as not to admit of the thought of a permanent separation. Just as no thought is possible without a brain or a corporeal

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equivalent thereof, so a normally constructed and nourished brain cannot exist without thinking; and if we want to imagine a thinking universal spirit, it can only be on the basis of a universal brain nourished with oxygenated blood. In this microcosmic phenomenon we behold only the repetition of the principal axiom of our philosophic naturalism, that force without matter is no more imaginable or possible than matter without force. A soul without a body, a spirit without physique, and a thought without substance, can no more be realised or exist than electricity, magnetism, undulations of heat, gravity, etc. can exist without those bodies or materials by the activity of which the phenomena designated by those names are produced.

In consonance with this, we have shewn in a subsequent chapter, that the animal and the human soul does not enter the world with innate ideas or thoughts, that it has no independent existence and is no *ens per se*, but that its development proceeds on parallel lines with the development and formation of the organs subserving it, and with the number, kind, and variety of the impressions received and the experiences undergone.

In presence of such an array of facts we have no hesitation in declaring ourselves fully as much opposed to all views which are connected with belief in individual immortality or with personal continuance after death. By the destruction and breaking-up of its material substratum, and the dissolution of the combination by which alone it attained conscious existence and became a person, a period is also put to the existence of the intellectual being which we have

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seen grow up only upon this double ground and in closest dependence thereon. All knowledge which has become a part of this being is related to things terrestrial; it has recognised and become conscious of itself only in, with, and through these things; it has become a person only by its separation from other earthly limited individualities; how can it be possible or imaginable that this being could exist self-consciously and as the same person, torn away from all these necessary conditions, which are the very breath of life for it? The idea of personal immortality is not supported by reflection, but by obstinate wilfulness — not by science, but by faith only. "Physiology," says *Carl Vogt*, "declares itself decidedly and categorically against individual immortality, as against all theories in general which include the special existence of a soul. The soul does not enter into the fœtus, as the evil spirit does into the possessed, but it is produced by the development of the brain, just the same as muscular activity is produced by the development of the muscles, or secretion is produced by a development of the glands. The psychical activities begin to develop after birth; but it is also after birth that the brain gradually attains the material structure peculiar to it. In the course of life the psychical activities undergo decided changes, and cease altogether with the death of the organ!"

Indeed, the simplest experience and observation of every-day life teaches us that psychical activity ceases with the destruction of its material substratum, or — *that man dies*. "The times have been," says *Macbeth*, "that when the brains were out, the man would die." There is no real proof, and none has ever

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been found, which should induce us to believe that the soul of a dead person lives on in one shape or in another. "That the soul of a dead person," says *Burmeister*, "ceases to exist at the moment of death, cannot be contradicted by sensible people. Spirits and spirit-manifestations have only been seen by sick or superstitious persons."

Having thus broadly laid down our view, we cannot refrain from going into some of the chief arguments which have been urged in favour of individual immortality, from the standpoint of a natural and moral study, based on sober and experimental science.

First of all, natural philosophers have attempted to deduce the immortality of the soul from the imperishable character of Nature and the indestructibility of matter and force. Inasmuch, it is urged, as there exists no absolute annihilation anywhere, it cannot be imagined or conceived that the human spirit, once in existence, can be brought to nought again; such an idea is contrary to reason and to the natural law. In opposition to this it should be remarked that a transitory manifestation of the "matter-and-force" principle must not be confounded with the principle itself. No doubt, in the eternal cycle of matters and forces, nothing is mortal; but this only holds good collectively, and for the whole, while the individual is subject to the unceasing changes of genesis and decay. While force and matter as such manifest their indestructibility in an incontrovertible manner, which rests upon experiments, the same cannot be said of the soul, which is only the effect or product of a definite combination of materials and forces subject to disassociation. With the breaking-up

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of this combination, its working must necessarily come to an end. If we break a watch to pieces, it will no longer tell the time of the day; if we kill the nightingale, its song subsides. We have nothing left before us but a heap of apparently dead materials, which must enter or be brought into new compounds or combinations, in order to bring about results similar to those previously obtained.

In perfect accord with this stand the fact that the personal soul, despite its alleged indestructibility, never existed for a whole eternity, that is to say during the time when the body to which it belongs, was not yet formed. But that which once did not exist, can perish and be destroyed again. Nay, it is in the very essence of everything that is brought into being, that it should also come to an end again.

There is actually a condition which enables us to produce a perfectly direct and experimental proof of the destructibility of the individual soul; it is the well-known condition of *sleep*. Owing to a retardation in the circulation of the blood and a diminution in the supply of blood to the brain, the function or activity of the organ of thought, which required that a very brisk reciprocal action should go on between the oxygen of the blood and the brain-matter, is disturbed or suspended in such a way that psychical or conscious phenomena cease for a time — just as the circulation ceases when the heart ceases to beat, or the oxidation of the blood is checked, if the lungs cease to act. The body alone lives on, in a condition similar to that of the animals from which Flourens had cut away the cerebral hemispheres. On waking, that is to say, upon the return of the normal

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circulation and of oxidation to the brain, the soul, which had been, as it were, bereaved of existence, continues its work at exactly the same point at which it had come to an end when sleep set in; the long interval had no existence for it; the soul was practically in a condition of spiritual death.

This peculiar analogy is so plain and so obvious that sleep and death have always been compared with each other and been styled brothers. "Death is like sleep," says Byron, "and sleep closes our eyelids." In the course of the first French revolution, the celebrated *Chaumette**) had statues of Sleep erected in the cemeteries and the following inscription put over the gates: "Death is an eternal sleep." Andreä, the Author of an old "Descriptio reipublicæ christianopolitanæ," from the year 1619, says: "This Republic knows nothing of death, and yet indeed is it present with them: but they call it sleep."

Now in opposition to this argument it has been contended that the phenomena of *dreams* afford a

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*) *Chaumette*, public prosecutor of the commune of Paris during the Revolution of 1792, and one of the leaders of the Hebertists, who had assumed the name of the Greek philosopher *Anaxagoras*, preached morality, industry, the patriotic virtues and reason; he suppressed houses of ill fame, turned all beggars and prostitutes out, opened on office for the poor to find employment, and closed the female club, to which women resorted to mix in politics to the detriment of their domestic duties. He issued a communal order that no religious practices should be carried on outside the churches; he prohibited the trade in relics and put a stop to public religious funerals; he planted the cemeteries with beautiful and fragrant flowers. He and his followers were overthrown by the fanatical *doctrinaire* and theist, *Robespierre*, and were guillotined on April 12th, 1794.

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complete proof of the psychical powers being active in sleep, though in a subordinate degree only. This argument is based on an error of fact, for the dreaming condition is not that of real sleep, but is a transition state between sleeping and waking, a sort of half-sleep. Persons in a perfect state of health do not even experience this transition; it is well known that they do not dream at all. Dreaming is considered at this day by medical authorities as a pathological or morbid condition.*) A deep or thoroughly healthy sleep knows of no dream, and a man suddenly roused from such sleep is, for a brief period, so entirely destitute of his psychical powers that whilst in this condition of being half awake and half asleep, he is considered as irresponsible in law. *A. Maury* having made some interesting experiments on himself, was brought to the conclusion, that dreaming results in almost all instances from some disturbance or change in some part of our organism, such disturbance reacting on the brain. According to him, a man, while dreaming, is like an insane person.

Certain morbid conditions are even more instructive than sleep in illustrating this temporary destructibility of our intellectual or psychical existence. There are disturbances arising in the activity of the brain from wounds, shocks, flashes of lightning, catalepsy, etc. which result in an entire loss of consciousness, or a complete cessation of all psychical phenomena. Such a condition may last for weeks and months. If the patient recovers, it is found that he has not the slightest remembrance of the condition through which he has

*) See Binz: "Ueber den Traum." Bonn, 1878.

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passed, and that he continues his psychical life exactly at the point in which consciousness left him; he has, as it were, been dead and come to life again. If, on the other hand, actual death ensues instead of recovery, the moment of this catastrophe is a matter of perfect indifference to the injured person; for as a person and as a psychically animated being, he had died at the moment when the disease put an end to the activity of his brain. It must be difficult, nay, quite impossible, for those who believe in the existence of an independent immortal soul, to explain the connection of such phenomena, and to give any reasonable theory as to how and where the soul, or that conscious Ego or Self which the philosophers talk so much about, has lived or continued its existence during such periods. No such theory can be produced, unless, in consonance with the superstitious ideas of former centuries, we assume that the soul leaves at times the body, somewhat in the form of a small animal, to travel about in unknown regions, in heaven, in hell, and so on, and eventually to return to its previous abode.

We also feel compelled to declare war upon those who, in contradistinction to the personal soul, hold with the existence of a universal spiritual matter, or fundamental soul, from which it is contended that the individual souls derive their origin, and into which they return subsequent to the destruction of the bodies to which they belonged. Such theories are as hypothetical as they are devoid of foundation. The expression "spiritual (*i. e.* immaterial) matter" is in itself a contradiction, like the ancient notions of imponderables, or matters that could not be weighed;

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it is a logical and empirical monstrosity. Neither would such an assumption improve the case of the advocates of personal immortality very much. For the return into the universal primal soul, with a surrender of individuality and personal continuance and of the memory of a former life, means very little less than annihilation; and it would be just the same for the individual whether his so-called psychical materials found further employment and use in the building-up of other souls, or not.

Attempts have of late years been made to utilise the "spiritual matter" or "soul-substance," to which we referred in the chapter on innate ideas, as a basis for individual or personal immortality. Prof. *R. Wagner* of Göttingen first spoke of an immaterial and individual soul-substance, temporarily united with the body, which upon the dissolution of the latter might travel to remote realms of space perhaps in the same way and with equal swiftness as light, and thence might occasionally revisit the earth. Such a theory is so utterly untenable, and the analogy between the ether of light and the pretended soul-substance is so hopelessly preposterous, as to make it an easy thing for Prof. Wagner's antagonist, *Carl Vogt*, to consign the whole of this discovery, made in the interest of the cause of personal continuance, to the realm of mere speculative fancies. (See his work: "Köhlerglaube und Wissenschaft, 1855.)*)

No greater value can be assigned to some further inventions in the province of natural philosophy made

*) Further details on the theory of the soul-substance and its untenability may be found in the Author's essay on the "Philosophie der Zeugung," in "Licht und Leben," pp. 302 *et seq.*

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in support of personal immortality, than to the theory of soul-substance. Thus, Herr *Drossbach,* among others, thinks he has discovered that each body contains an infinite number of monads, capable of self-consciousness, which gradually attain by development to consciousness, or, when death ensues, fall to pieces again. These monads combine again at some very remote period, or in other worlds, and form a new man with a reminiscence of his former life! Really, these monads are too intangible for any one to have anything further to say about them.

While the destructibility of the human soul after death has been impugned from the standpoint of natural philosophy, a similar attempt has been made with the same object from a moral point of point — and, it seems to us, with exactly the same success. First, it has been contended that the idea of everlasting annihilation is so repugnant to all human sensation and so revoltant against human feeling, that on this ground alone, it must necessarily be fallacious. Now quite apart from the fact that such an appeal to feeling cannot supply the want of scientific reasons, it must be urged that the thought of an everlasting life, or the impossibility of dying, is far more terrible and much more revolting to human feeling than that of everlasting annihilation. Even in the province of legends, this horror has been expressed in the ingenious story of the undying Ahasverus — the "Wandering Jew." To ask for eternal life would, as Galilei remarked, be tantamount to clamouring for petrifaction.

On the contrary, the idea of the annihilation and cessation of individual life has nothing terrible in it

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for the mind of a man with a philosophic thought about him. Not to exist, as the profound religion of Buddha has so clearly recognised, amounts to perfect rest, painlessness, freedom from all impressions that rack and torment the corporeal or mental being, and it is therefore not to be apprehended, but rather to be ardently desired after the completion of a normal life, and upon the appearance of the unavoidable infirmities of old age. There can be no pain in annihilation, any more than in the repose of sleep; *the sense of death is most in apprehension* (Shakespeare). "The fear of death naturally felt by all men," says *Kant*, "even by the most unfortunate and also the wisest, is not a dread of dying, but as *Montaigne* rightly remarks, or a horror of the thought *of being dead;* the subject of death imagines he will preserve this thought after death, because he thinks of the corpse, which is no longer himself; he imagines that his own self will come to lie in some dark tomb or elsewhere." With equal cogency *Fichte* says: "It is quite clear that he who does not exist can feel no sort of pain. Upon this ground, annihilation, if it occurs, is no evil at all." The clear-headed Roman Catholic priest, *Jean Meslier* writes to the same effect: — "Is the fear of not lasting for ever, more sad than that of not having existed from time immemorial? The fear of losing consciousness is in reality but a sentimental grievance to which alone is due the dogma of a future life." And *Socrates* says in Plato (*Apologia Socratis*) that death, even if it deprives us for ever of consciousness, is a wondrous gain, just as a deep dreamless sleep is preferable any day to the happiest life. It would be easy to glean

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from the Greek tragedians a whole anthology of similar expressions and sayings.

Has anybody ever grieved because he was not in existence when the Greeks besieged Troy? Neither need we grieve because we shall not be in existence when events of the future stir up the world and mankind. Rather should those who require comfort, rejoice in the thought that these things of the future are the fruit of the present, and that they cannot come about without his co-operation. He who wishes for immortality must not desire it for himself or his own poor individuality, which is but as a single ripple in the vast ocean of existence, but for the share which he, as an individual, has contributed to the existence of the *ensemble*. Be this contribution large or small, it cannot perish in the life of the whole, but works on to all eternity, just as in the eternal cycle of forces not even the smallest movement can be lost, without breaking the irrefragable law of cause and effect. How truly does Schiller say:

"Vor dem Tode erschrickst Du? Du wünschest unsterblich zu leben?
"Leb' im Ganzen! Wenn Du lange dahin bist, es bleibt!"

("Art thou afraid of death? Wilt thou live for ever? Then live in the whole. When thou shalt have long been gone, it still remains!")

Rückert expresses the same thought in the words:

"Vernichtung weht Dich an, so lang Du Einzler bist,
"O, fühl' im Ganzen Dich, das unvernichtbar ist!"

("Annihilation breathes on thee while thou art a solitary. Oh feel thyself part of the All, which is indestructible!")

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The scholastic philosophers, who feel the untenability of the ground on which they stand with regard to this question of immortality, but who are determined to yoke together philosophy and faith, have tried to extricate themselves from the difficulty in a very extraordinary and unphilosophic manner. "The longings of our nature," says *M. Carrière*, for instance, "the endeavours of knowledge to solve so many problems, demand immortality, and the many sorrows of this earth would form a horrible discord in the harmony of the universe, if these problems did not find their solution in a superior harmony, by the fact of those longings and yearnings producing their fruit in the purification and development of the individual. These and other considerations make immortality, in our estimation, a subjective certainty and a conviction of the heart."

Every one, indeed, may have "convictions of the heart." But such convictions should not presume to come forward in a philosophic garb. It may be that we are surrounded by many problems, the solving of which would give great pleasure to thoughtful minds. But we come no nearer to their solution by "convictions of the heart," or by the mad mental gymnastics of schoolmasters, but by sober reflection, based on reason and experience; and the conclusion to which we must necessarily be led by such reflection, is the finality of the person or of the individual as a transitory phenomenon in the general life of Nature. A real unveiling of the enigmatic character of the universe, such as Herr Carrière seems to ask for, that is to say, the acquirement of a perfect knowledge by the human mind, must, on internal grounds, be regarded as an

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frorosolute impossibility. Without strife there can be mino life; absolute truth would be death to him who should grasp it, and he would perish in apathy and indolence. *Lessing* associated with this idea such a conception of weariness that it caused him "woe and anguish."

If, however, it be suggested that we should be content with an everlasting and ever more perfect strife in another world, nothing would be gained by this in regard to the question of the finality or endlessness of the human spirit; the decision would only be carried a little further back. The second life would be an enlarged and improved edition of the first, with the same fundamental defects, the same contradictions, the same final absence of results. But like candidates for government offices, who prefer an appointment at some indefinite date to none at all, thousands upon thousands cling in their mental agony to the uncertain prospect of an everlasting or temporary continuance of life.

The philosophers who, in regard to this question of immortality, do not hesitate in making short work of the philosophical method by which, at other times, they set so much store, and to appeal to an indefinite super-sensationalism, scarcely deserve to be answered. The famous philosopher *Fichte* lays down the law as follows: "Eternal continuance cannot be explained on mere natural conditions, nor need it be, since it is far above Nature. If, from a sensational and empirical standpoint, we cannot see how eternal continuance is possible, it must yet be possible, seeing that it lies in that which is above all nature." It stands to reason that decrees of this

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kind can be binding only on those who *believe* and *will* believe, and who, therefore, do not need them; all others will find it natural to put the standard of human intellectual knowledge to a controversial question, and will look for a solution of it to experience, reason and natural science. In this investigation they will find that Fichte was right when he asked that natural and sensational intelligence should be forsaken in order to grasp the possibility of personal immortality.

We should like to point out quite cursorily and in a few words the difficulties and absurdities which, if personal immortality were a truth, must result from the continued and simultaneous existence of the countless troops and hosts of souls, that had belonged to the living men or rational inhabitants of other worlds. From the results arrived at in earlier chapters (on the construction of the heavens and the universality of natural laws) it is seen to be impossible and inconceivable from the naturalistic standpoint, that any place can exist outside the earth in which the departed souls could gather when freed from the ties of the law of gravitation. Even if this difficulty about dwelling places did not exist, there would still be the excessive disparity between the departed, in their moral and intellectual degrees of civilisation, that must necessarily stand in the way of their living together after leaving the earth. Life in eternity, according to the tolerably unanimous opinions of theologians and philosophers, is to be a continuation of or improvement upon the life in this world. It must therefore seem to be indispensable that each individual soul should at least have reached on earth

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a certain stage of formation as a groundwork for its further development to proceed upon. But now only think of the souls of children dying in infancy, of old people who had lapsed into second childhood, of insane persons, of idiots, of badly trained individuals, of irresponsible beings, of savage nations, or of those standing on the lowest rungs of the ladder of our European Society. Are the defects in civilisation and education to be continued in the other world on the same or on a higher scale? "I am sick and tired of sitting on school-forms" says *Danton* in *Georg Büchner's* famous drama, "Danton's Tod." This shews clearly the reason why human fancy has been far less fertile in painting the hoped-for joys of heaven than in depicting the everlasting torments of hell. People found it impossible to form a tenable conception of the pleasures of a condition in which, according to the Christian view, they would have nothing to do except to glorify God for ever. On the contrary, the numerous sufferings and terrors of earthly existence have yielded materials enough and to spare for artists to picture the reverse of the medal.

And, lastly, let us ask, — If the doctrine of the immortality of the soul be true, what is to become of the souls of animals? Human pride has only considered this matter with regard to mankind, and has refused to see that animals, to whom the possession of a soul (though it be but an animal soul) can no more be denied than it can to man, have exactly the same right as man himself. The difference existing between human and animal souls is not a fundamental one, but only a question of degree; and that the roots and beginnings of the highest mental and

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psychical capabilities of mankind find their counterpart in the animal world, will be shewn in a subsequent chapter; it is a difference of grade or development, not of kind. *Burmeister* has therefore a perfect right to say: — "If the human soul be immortal, the animal soul must be so too. Both must have similar claims to immortality by virtue of the similarity of their fundamental qualities." If this inference be followed out down to the lowest animal types — to which a soul, in the most general sense, can no more be denied than it can to the highest — and if we proceed right down to the monera or simplest primal organisms, then all the moral grounds on which the arguments for individual immortality have been based, tumble to pieces, and absurdities result which must destroy the whole fabric of foolish hopes.*)

Nor must it be forgotten that the soul of an intelligent animal, like that of a dog, ape or elephant, stands beyond all doubt much higher in the intellectual scale than that of a human idiot, *cretin* or maniac. Would it not be an unwarrantable contradiction to admit immortality for the latter, and not for the former?

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*) The missionary *Moffat* tells an interesting anecdote, which shews very plainly the view taken by savage peoples unfettered by dogmas. A member of the *Bechuana* tribe (in the interior of South Africa) came to him one day and asked, pointing to his dog: "What difference is there between me and this creature? You say, I am immortal; why not my ox and my dog? They die, and do you notice anything of their souls? What is the difference between man and animal? None, save that man is the greater rascal of the two." (See Ausland, 1856, Nr. 33.)

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Lastly, it has been, and is still asserted, that the idea of immortality, like the idea of God, is innate in the innermost intellectual being of man, and is therefore undeniable on all rational grounds. For the same reason, it is further alleged, there is no religion which does not cling to personal immortality as one of its first and chief axioms. As to innate ideas, we have already spoken of them at sufficient length; and as regards nations or religions and religious sects, within which there exists no such thing as an idea of immortality, there are no end of them, and it would be more accurate to say that only a comparatively small portion of mankind are found adhering to that idea. Although the *Jews* may be regarded as harbingers of Christianity, their chief sects recognised no personal immortality. The enlightened sect of the *Sadducees* taught, as against their opponents the Pharisees or "Jesuits" of Judaism, that the human soul does not outlive the body, but is dissolved with it into planetary atoms and undergoes many other transmutations. According to them, there is no resurrection of the dead; the fate of man lies in his own hand. Men must serve God from pure love, not from self-interest or fear. This doctrine in no way deteriorated the morality of its adherents, who would yet partake of the enjoyments of life without any compunction. According to *Richter* (Vorträge über persönliche Fortdauer), by far the largest number of our theologians are agreed in that there are, in the books of the Old Testament written before the Babylonian captivity, no clear traces of the doctrine of individual life beyond the grave. The Mosaic law never points to a reward in heaven and after death.

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The original religion of the great *Confutsee* or Confucius knew just as little of a future celestial world, of a deity external to the universe, of dogmas and priests, as did the ancient popular Chinese religion which it supplanted. Both are nothing but colourable or cultured Atheism and Materialism, and rest on a thoroughly realistic conception of the world. Confucius, as mentioned in an earlier chapter, never speaks of a Creator nor of a higher order of the world, and a pious regard for one's ancestors is the only precept of his religion which goes beyond the individual life.

The famous *Buddhism*, one of the oldest, and at the same time the most widely spread, of all religious systems of the world, embracing, as it does, 31 per cent. of the entire human race, knows nothing of personal immortality, and preaches (like our modern pessimists Leopardi, Hartmann etc.) *non-existence*, or the definite cessation of personal existence, in the famous *Nirvana* or nothingness, as the highest aim of deliverance.*)

The noble Greek nation, whose civilization stood in many respects high above that of our conceited age, believed only in a realm of shadows as the abode of the departed. This so-called Hades, however, was for them no place of blessedness, but only a lurid reflex of real life, or the grave poetically conceived. Their great poet Homer painted it in the gloomiest colours, and makes Achilles, as the ruler of the dead, say to Odysseus (Odyssey, XI. 14—19): —

*) See Appendix A.

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"Rather I'd choose laboriously to bear
"A weight of woes, and breathe the vital air,
"A slave to some poor hind that toils for bread,
"Than reign the sceptred monarch of the dead."

which sentiments are found in a slightly different garb in Shakespeare's "Measure for Measure," III, 1: —

"The weariest and most loathed worldly life
"That age, ache, penury and imprisonment
"Can lay on nature, is a paradise
"To what we fear of death."

The famous "Book of the Dead" of the ancient Egyptians also understands the judgment which awaits each soul after death, not in the Christian sense, but only in relation to the safest mode of burial. It was not until the school of Plato became more powerful that the dogma of the immortality of the soul began to spread among the Greeks, causing, in doing so, the greatest disturbances (as is related on p. 281 of the "*Système de la Nature*," vol. I, note 78, on the "*Argument du dialogue de Phédon, de la traduction the Dacier*"); for men, discontented with their lot, proceeded to take away their own lives. *Ptolemy Philadelphus*, king of Egypt (so the story proceeds), on seeing what results this dogma, now thought to be so full of blessing, wrought on the brains of his subjects, forbade the teaching of it under penalty of death.*)

*) Similar results have even come to light within our own time. At the beginning of this century a *deistical* sect arose in Buddhist Burmah, which believed in an omnipotent and omniscient Nat (spirit) as the creator of the world, and taught a species of immortality. The present king had fourteen of these "heretics" brought to the gallows, and cruelly persecuted the sect. (See "Ausland," 1858, Nr. 19.)

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Travellers tell us of a good many savage tribes among whom the belief in the personal continuance after death does not exist at all, or, if it does, only in combination with ideas that make it meaningless or subvert it. (See *Meiners'* "Kritische Geschichte der Religionen, 1806 and 1807.) *Bates* relates of the Indians of the Upper Amazon (vol. II, p. 214) that no trace can be found among them of any belief in a future state, that only those who have had intercourse with white men speak of it, and even then only without evincing the least interest in the matter. Dr. *J. W. Helfer* relates of the *Seelongs* of India that they know nothing of a life after death, and that their invariable answer to questions on such matters is: "We do not think about it." A good many similar examples have already been given.

Among all nations and in all ages, the belief in immortality has never had many adherents in the ranks of cultured and enlightened people, although for reasons easily to be understood, these have not always brought their opinions and ideas forward with as much energy as those holding opposite views. What an amount of abuse had not the famous *Voltaire* to endure, because he ventured to announce his belief in the perishable character of the human soul! And even in our time, which boasts so loudly of its enlightenment, the great *David Friedrich Strauss* fared not a whit better. "I go into nothingness," said *Mirabeau* on his deathbed: and the mighty *Danton*, on being asked before the revolutionary tribunal about his calling and abode, answered: "My abode will soon be in nothingness!" One of our greatest German thinkers, *Frederick the Great*, confessed that he did not believe in personal immortality.

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How very much, in the present century, despite all the allegations and assurances of theologians to the contrary, the general views both of the educated and uneducated classes are in this matter opposed to the dogmas of the Church, can be denied by no one who has opportunities of observing people in positions of life in which hypocrisy and dissembling are out of the question. "Who with eyes in his head," says *Feuerbach* very correctly, "can deny that belief in individual immortality has long since vanished from *ordinary* life, and only exists in the subjective fancy of individuals, however numerous these may be?" Else, how could the fear of death be explained which still prevails among mankind, despite all the comforts of religion? How would it be possible that the majority of men should regard death as the greatest evil, in that it puts a sudden end to the brief joys of their existence? or because it only leads to that state so terrible in the fancy of the living,

Wo Sonn' und Mond nicht glänzen
Und keiner Sterne Licht,
Wo keines Aethers Scheinen
Die ew'ge Nacht durchbricht.

Wo Wälder nicht, noch Wiesen
Erglüh'n in grüner Pracht,
Wo keiner Quelle Rauschen
Die Luft ertönen macht.

Wo keines Vogels Singen,
Kein Klang, kein Ton der Lust,
Kein Lied, kein Wort der Liebe
Bewegt die Menschenbrust.

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Wo nur ein ewig Schlafen
In ewig dunkler Nacht
Der kurzen Lust des Lebens
Ein ewig Ende macht.

(When there is no light of sun, moon or stars, when no eternal radiance pierces through the eternal night; when neither woods nor meadows smile in emerald glory, when no murmuring of springs makes the air resound; when man's heart is never moved by the melody of birds, by sound or note of gladness, by song, or by word of love; when only an eternal sleep in an eternal night puts an eternal end to the brief joy of life.)

This same emotion, united to the thought of the transitory nature of all earthly things, is expressed in the beautiful lines of Platen, our great poet: —

"Warum erfreun wir uns am Klang der Leyer,
"Am holden Spiel, an tausend süssen Trieben,
"Wenn stets im Hintergrund die Furie lauert
"Und unser Leben zwo Sekunden dauert?"

(Why do we rejoice in the sound of the lyre, in the sweet tunes, in a thousand joyful delights, if the Fury is ever lurking in the background, and we have but two seconds to live?")

Lastly, let us listen, to the beautiful and striking words uttered on the subject by an Italian philosopher, *Petrus Pomponatius*, who lived at the beginning of the 16th century: "If we assume the continued existence of the individual, we must first of all prove that the soul can live without requiring the body as subject or object of its activity. We cannot

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think without sensations; but these depend on corporeality and its organs. Thought is in itself eternal and immaterial, but human thought is bound up with the senses; it can recognise the general only in the special, it is never free from the rule of space and time, for its ideas come and go one after the other. Our soul is therefore really mortal, since neither consciousness nor memory can endure." And again: — "Virtue is far purer when practised for its own sake, than for a reward. Yet must those politicians not be blamed who desire that the immortality of the soul should be taught for the sake of the public good, in order that the weak and the bad might at least go the right way under the impulse of hope or fear, while noble free spirits choose that path of their own accord. *For it is utterly untrue that only base scholars have denied immortality, and that all noble sages have adopted it. Homer, Pliny, Simonides and Seneca, who did not cherish this hope, were not vile on that account; they only managed to get along without mercenary servility.*"

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VITAL FORCE.

If we seriously believe that natufal laws could once be arbitrarily set aside by life, then all investigation of nature as well as of souls must cease.

Ule.

Many people imagine that they have expressed and explained everything with the words "vital force"; yet they have only made an idle use of a hidden and indefinite cause, which explains nothing, and is but a confession of ignorance.

Onimus.

No physiologist thinks nowadays of looking upon any phenomena of life as the result of a marvellous vital force, or a special purposively active force, existing apart from outside matter, and only taking the physico-chemical forces into its service, so to speak.

Haeckel.

The theory of a special vital force leads necessarily to such absurdities, that at this day no naturalist thinks thereof, who has any *serious* claim to that title.

Pivany.

Among the mystical notions, so destructive of all clearness of idea in natural philosophy, which were put forward at a time deficient in knowledge of nature, and which modern research has entirely thrown overboard, we may reckon more particularly the idea of a so-called *vital force*. There is scarcely any theory that has at any time more deeply injured the cause

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of science than the idea of a special organised force, which has been set up as a sort of *antagonist* of the inorganic forces, such as weight, affinity, light, heat, electricity, magnetism, etc., or as independent of them, and which should serve as an exceptional natural law for living things, rendering it possible to withdraw them from the influence and action of the universal laws of nature, and to form, so to speak, a law on its own account and a state within the state. If science were compelled to recognise such a law our axiom of the universality of physical laws and of the invariability or the very existence of an order in nature would collapse altogether. Fortunately, science, instead of being in this matter compelled to retreat before the irrational onset of dynamists or believers in force, has gained a brilliant victory over them all along the line; she has gathered together such a mass of striking facts that the theory of a special vital force as the cause and foundation of vital phenomena has now nothing left to it but to haunt the borders of exact science like a ghost, to wander about in the heads of conceited philosophers or of those who have remained far behind their age in scientific thought*). "For" as Virchow very pertinently remarks (Archiv für path. Anat. und Physiol., IX, vol. 1856, part 1 and 2), "this old doctrine of a vital force is not an erroneous teaching, but a mere superstition, the relationship of which to the doctrine of the devil and to the search

*) Even a thinker of such high standing as *A. Schopenhauer* could not, owing to his philosophic prejudices and his pet theories, free himself from the idea of a vital force, and styled attacks on it simply as "stupid." See the Author's "Aus Natur und Wissenschaft," p. 129.

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for the philosopher's stone cannot be denied." And as far back as eight years previously, Prof. *Dubois-Reymond* felt justified in saying in his famous "Untersuchungen über thierische Elektricität": "Those who try to maintain and to preach the erroneous doctrine of vital force, *under whatever form, and in ever so deceptive a garb*, are men who cannot possibly have ever attained the limits of their faculty of thought."

There can at this day be no scientific doubt that life obeys no special or exceptional laws, and that it does not stand outside the influence of inorganic forces, but must rather be regarded as the result of a definite interaction of chemical and physical forces or a peculiarly complicated mechanical group of motions, for the explanation of which none but the usual and known forces of nature can and need be called in. He who thinks it necessary to conceive a theory of a special "vital force" in order to explain life, argues as rationally as one who tries to make out that the movements of a watch are traceable to the working of some special "watch-force," and not to its mechanical organization. But just as the movement of a watch is nought but the result of materials and forces working together in a particular manner, so life also is no *force*, but a *resultant* or movement of particles grouped in a definite order.

With a view to prove this more fully and with more precision, we need but refer to chemistry, which was able to place the fact beyond doubt that the chemical elements or fundamental materials are identically the same in the organic and in the inorganic world, and that not a single atom in the physical groundwork of life occurs which is not equally present in the

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inorganic world, and active in the cycle of material changes. Chemists have succeeded in decomposing organic bodies and compounds into their elements, and in separating these severally from each other, exactly in the same way that they had long before done in the case of inorganic bodies; they have thus proved, as we have said, that these elements are the same in both departments, and that it is only the method of grouping which varies. For example, a living being can be reduced into a lot of inorganic compounds by a process of complete combustion, so that nothing remains except the non-volatile ashes, and this without a single atom being lost in the process.

This one fact alone should suffice to relegate every idea of a special vital force from science, since that force, as shewn in an earlier chapter, cannot be separated from matter, and each movement occurring on such a basis must result from the conditions, capacities or forces inherent in the atoms. The properties of the atoms are, as it has been more scientifically expressed, indestructible, and no educated person can admit that the merest particle of oxygen can change its essential and indestructible nature within an organism; that, for instance, an atom of oxygen *within* an organism can be influenced by an adjoining atom of hydrogen otherwise or by other natural laws, and *vice versâ*, than it would be if placed *outside* that organism. Life creates neither new matter nor new force; it only delights in countless changes, which proceed without exception according to the great law of the conservation of energy or the equivalency of all dynamic forces. Each contraction of a muscle, each kind of work performed

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by an organism, involves the disappearance of a perfectly definite and equivalent amount of heat. If organic or living bodies manifest properties differing from those of the inorganic, it is not from the working of a special force present within them, but only from the peculiarity of their chemical composition, which makes the effect appear as a transitory manifestation of universal matter. Vital force is therefore no principle, but, as remarked heretofore, a result. When an organic compound appropriates and assimilates inorganic matter that exists in its proximity, it does not do so by virtue of a special power, but only by a process of contagion, whereby it transmits to the other molecular arrangements of its own particles of matter, just in the same way as in the inorganic world energies are transmitted from particle to particle. In this way, the genesis of the whole organic world from one or more beginnings, however small, may easily be explained, without resorting to the notion of vital force. In the chapter on primeval generation we have already shewn how such a beginning may and must have occurred.

It is generally known that manifestations of life occur habitually only when albuminous compounds are present. When these are absent, there are no phenomena of life. To this it may doubtless be answered that these compounds are also present in death. But in death they are obviously in a state of transition towards quite a different chemical or physical condition, which supervenes not suddenly, but gradually. For even death, which is erroneously looked upon as the opposite of life, cannot possibly extinguish vital functions all at once. The isolated muscular

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fibre, removed from the body, contracts when under the influence of electricity; and even hearts, when removed from the body and thrown out of all their normal connections, continue to beat or to move for hours and days together. Nay, severed pieces continue to move or pulsate, offering to the observer quite a peculiar and weird aspect. In men who had been executed, movements of the heart have been observed for many hours after death. Blood-corpuscles can be poisoned with carbonic oxide in the re-agent tube quite as well as in the blood-vessel itself. The hair-bulb continues to form its peculiar products in the corpse, and the liver keeps to producing glycogen. After death by cholera the temperature of the tissues rises instead of falling. The severed heads of beasts, as mentioned in the chapter on the seat of the soul, may be recalled to life and consciousness by the injection of oxygenated blood, and so on.

If, after this general exposition, we glance at individual instances, we find that not only *simple* elementary substances, such as oxygen, hydrogen, carbon, nitrogen, etc. enter into the chemical composition of the living body in the most varied ways, without in any manner changing their nature, but that this is also the case in regard to *composite* bodies. Water, which must be regarded as the chief, and in many instances by far the greatest part of all organised beings, and without which no animal or vegetable life is possible, penetrates, softens, dissolves, flows, falls by the law of gravity, evaporates, condenses, and conducts itself within the organism in a manner that differs not even by a hair's breadth from the way it does outside. The salts of calcium which

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it contains in solution, are deposited by it in the bones of animals or the tissues of plants, where they shew the same solidity as in inorganic nature. The oxygen of the air, which acts on the dark venous blood in the lungs, follows exactly the universal natural law of the diffusion of gases, and imparts to the blood the same bright-red color which is likewise obtained by shaking up air and blood in any vessel. The carbon contained in the blood forms carbonic acid by combustion through this union, which takes place not only in the lungs, but also in every part and tissue of the body, just as in every combustion of a carboniferous compound, thus producing the remarkable phenomenon of animal heat which is not therefore, as was thought formerly, a product of vital force, but is brought about in exactly the same or in a similar way as the heat of an oven in which wood or coal is burnt.*)

In point of fact, every activity of an organ is connected with a chemical change, which proceeds inside the living body according to exactly the same laws as outside. The animal stomach may correctly be described as a chemical retort, in which the substances brought into contact with one another dissociate and re-combine themselves in perfect accord with the laws of chemical affinity. A poison introduced into the stomach can be neutralised by a chemical antidote, just in the same way as though the proceeding had taken place outside; a morbid substance present therein can also be neutralised and

*) See further details on this in the Author's "Physiologische Bilder," vol. I, p. 130 *et seq.*

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destroyed by chemical substances introduced in it, just the same as in any inorganic vessel. The chemical changes undergone by food during its stay in the stomach and the intestines have been ascertained in modern times almost down to their most minute details, and so has been the way in which they are changed into the tissues and compounds of the body. We know equally well that their elementary materials leave the body again by various roads to the same amount as they entered it; partly unchanged, partly in other forms and conditions. Not a single atom is lost in this way or changed into another. Digestion is a purely chemical process. We learn the same from the action of medicines which is purely chemical, except where mechanical forces come also into play. All medicines which are insoluble in the fluids of the animal organism and can therefore produce no chemical reactions, must necessarily be regarded as perfectly ineffective.

What applies to the *chemical*, applies likewise to the *physical* processes going on within the living body, The circulation of the blood is as perfectly mechanical as can possibly imagined, and the anatomical arrangements which have that circulation for their object, bear a most remarkable resemblance to the mechanical works of the human hand. The heart is furnished with valves like a steam-engine, and the closing of these valves produces a loud, audible noise. The air, on entering the lungs, undergoes friction against the sides of the air-tubes, and causes the respiratory sound. Its ingress and egress are induced by purely physical forces. The rising of the blood from the lower limbs to the heart, in opposition to the

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law of gravity, is rendered possible only by purely mechanical arrangements. The intestine propels its contents mechanically by peristaltic activity; all muscular actions are mechanical, and to them are to be traced the movements performed by both men and animals in walking. The construction of the eye rests on the same laws as does the construction of a camera obscura, and the ear receives the waves of sound like any other cavity.

If, as must be acknowledged, many of the processes going on in the living organism are not as yet explicable by physical or chemical phenomena, and if we are still met by problem upon problem, we ought not to hold Nature responsible for this, but only the imperfection of our knowledge. However, as time goes on and Science makes more and more headway, there is a gradual subsidence of the obstacles that are still to be found in the path of a mechanical explanation of vital phenomena. Let us think of our latest acquirements, and remember how, within a comparatively small number of years, so many phenomena have been conclusively explained which in their obscurity appeared heretofore as the most powerful advocates of the case of those who held with miraculous vital energies. How long is it since the chemistry of respiration or digestion first became known; how long since the processes of generation and fertilisation emerged from their mystic darkness, to be classed among the simplest mechanical actions of the inorganic world? The seed is no longer regarded as a living fluid, giving out an enlivening vapour, but as a matter moving mechanically through the instrumentality of the spermatozoa; and what was heretofore

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looked upon as the mysterious action of that enlivening vapour, resolves itself directly and mechanically into the contact of ovum and sperm. How many processes going on within the animal body, such as the rising of small particles on the mucous membrane and towards the exterior, contrary to the law of gravitation, seemed inexplicable and appeared to call for the theory of a vital force, until the interesting phenomenon of ciliate motion, a process resting on purely mechanical principles, was brought to light. This remarkable movement is independent of vital energies, and continues long after death; it is brought to an end only with the complete softening of the organised parts through putrefaction. In a turtle, as late as fifteen days after death, while the flesh was falling away into putrid slime, the ciliated cells were still engaged in their peculiar motion. What an amount of light was thrown on the wonderful processes going on within the blood by the discovery of blood-corpuscles, and on the processes of absorption and resorption by the discovery of the laws of endosmosis and exosmosis! That marvellous and apparently incomprehensible physiological activity of the animal body, the *nervous*, is now having quite a new light thrown upon it by natural philosophy; and every day it is becoming more obvious that *electricity*, a well-known natural force, plays a most important part in these organic phenomena.

"Life," says Virchow, "is only a particular kind of mechanics; it is, in point of fact, the most complicated form thereof, it is that in which the ordinary mechanical laws are brought into play under the most unusual and varied conditions; hence, the final results

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are separated from the beginnings of the change by so great a number of swiftly subsiding, intermediate links, that we can find the connection only with the very greatest difficulty." — "The living organism," says Professor *Matteucci*, "is a machine, like the steam-engine or the electro-magnetic machine; that is to say, a system in which chemical affinities, especially the union of the oxygen of the air with the materials of alimentation, produce heat, electricity and muscular work." He might have added, "and mental work too," for we know that without chemical, mechanical and physical changes, not only no movement can exist, but no feeling, no thought, and no volition either. Sensation is only a special mode of motion of organised matter; and since, as we have shewn already, all psychical activity may be traced, in the last instance, to the elements of sensation (just as all bodily organisation is formed by groupings of the "cells"), the highest activity of the living organism forms no exception to the general rule. All matter is *capable* of sensation, and every living body *sensates*.

To the chemists, who deny the necessity of the theory of a vital force, it has been retorted that Chemistry itself is unable to form organised compounds, that is to say, to make those special groupings of chemical elements in ternary or quaternary compounds, the realisation of which implies in each instance that of an organic being endowed with life and vital power; and those who made this retort courteous, added thereto this funny remark that if there were no such thing as vital force and if life were only a product of chemical action, then chemists would be able to produce organised beings in

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their retorts and perhaps actually to make men!*) This suggestion has not been left unanswered by the chemists. They have shewn that Chemistry is perfectly able to build up the fundamental constituents of organic life. Thus the French chemist *Berthelot* succeeded in making *ethane*, the fundamental binary compound of organic chemistry, out of nothing but its elements, carbon and hydrogen, and by the help only of the forces working in inorganic nature; he thus procured for *synthesis* or the artificial composition of organic bodies, a starting-point that could not possibly be dependent on organic nature.**) "We must therefore conclude," as Berthelot says, "that

*) This insinuation is funny, because our opponents forget that, in order to produce organic beings it is not enough to have the chemical materials in hand, out of which these are formed, but that, in order to produce such bodies, it is necessary that a number of difficult and complicated conditions should be complied with, which conditions we are quite unable to bring about artificially, and among which the indispensable influence of protracted periods of time plays a principal part. But there are also a number of inorganic bodies which we cannot produce artificially, and yet no one supposes that these owe their origin to anything but physico-chemical processes. Among these may be mentioned the diamond, precious stones, quartz, granite, topaz, malachite, lava, etc. etc. The reader can consult on this point the close of the first essay in the Author's "Die Darwin'sche Theorie in sechs Vorlesungen." (Leipzig, 1876.)

**) Berthelot first united carbon and hydrogen into acetylene with the aid of electricity, and then formed olefiant gas, or ethane, by the addition of hydrogen. All the other hydrocarbons can be built up from acetylene. Bertholet made methyl-alcohol out of marsh-gas and oxygen; out of the same and the elements of water he made ordinary alcohol; out of alcohol and hydrocarbons he formed the organic acids; and out of alcohol and ammoniac he made the amide and organic bases, etc.

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organic chemistry now rests on the same experimental principles as inorganic. In both sciences, synthesis, as well as analysis, has only the action of the same forces on the same elements to go by. . . . The task of synthesis is to determine the precise composition of bodies and to yield the proof that the fundamental laws of inorganic and organic chemistry are identical." For this reason it has become impossible at this day to speak of a special organic chemistry, except for the sake of convenience, and the line formerly drawn between organic and inorganic chemistry (the first of which is now usually called the chemistry of carbon or of the compounds of carbon) is at present but "a conventional aid for classification, which in no wise corresponds to the nature of the phenomena, but which we only preserve for convenience." (Dr. Schiel.) Synthetical chemistry has of late years made such rapid strides, and still goes on progressing at such a rate, that it is impossible as yet to see where her bold advances, which have already produced such great results, are to stop.*)

If the view mentioned hereinbefore, viz. that ternary and quaternary compounds can only be originated by vital force, were carried to its legitimate conclusions, it would become necessary to deny vital force precisely to those organised beings in whom the principle of *life* is most highly developed; for it is well known that animals lack the power to form organic compounds out of inorganic, and that they are therefore absolutely dependent for their subsistence on the vegetable world, which alone is able to turn inorganic into organic substances.

*) See Appendix B.

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From all this no one, who values facts and is acquainted with the method of scientific induction, can have the least doubt that the conception of a special organic force, which produces phenomena of life independently and apart from the universal laws of nature, must be banished from the province of life and science; that nature with its matter and force is one single indivisible whole, without limits or exceptions; again, that the hard and fast line of division, which some have sought to draw between organic and inorganic, can only be a forced one, and that a difference between the two exists only in the outward form and in the grouping of the material atoms, but by no means in the intrinsic character. The difference between organic and inorganic forms arises in reality but from the fact that the first grouping of the molecules is different, and being so, includes the germ of those forms. But the structure of the crystal and the remarkable phenomena of the reparation of injured crystals prove that there exist in the inorganic world certain laws of form that cannot be infringed, and which come very close to those of the organic world. Modern research has shewn that the *crystal*, being the *inorganic* primal form, stands in a much nearer relation and analogy to the *cell*, or organic primal form, than was formerly supposed to be the case. Both use selection as to that which they take up from their surroundings: both are subject to definite external influences in their formation; both can evolve themselves out of the same compounds of materials. As we noted heretofore on pp. 89 and 90, certain microscopic crystals (named crystalloids by Nägeli), which have been found in the interior of plant

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and animal cells, are capable of imbibing, that is to say, they take in fluid matters from outside and swell up just like cells. They thus shew all the essential properties of protoplasms or the albuminous contents of the cell, wherefore they were named "protein crystals" by *Reichert*, who first discovered them in the interior of the animal body, in 1849. Crystalloids have been produced by crystallising artificially-formed carbon-compounds. Their curved sides obviously yield a transitional form from the true crystals proper to the forms of living nature, and the cause of these appears to reside in the peculiar character of carbon, which lies at the root of the organic world; of this we have a proof of the diamond with its curved sides, which consists of pure carbon. "The wide gulf," says Prof. *Cohn*, of Breslau, at the close of a circumstantial work on these remarkable bodies, "which has hitherto separated the crystals of the inorganic world from the organised cellular forms of the plant and animal worlds, is filled up by the protein crystals."*)

Those who still cling to the theory of a vital force are fighting a hopeless battle. Let individual mystics among naturalists try, as they may, to instil fresh life into the corpse; let any number of philosophers mourn the loss of this favourite child of the spiritualistic confusion of thoughts; how forcibly soever some may go on pointing to the inexplicability and obscurity of many processes of life, — the doom of the theory alluded to must nevertheless be looked

*) See on this the Author's "Physiologische Bilder," vol. I of the 2nd ed., pp. 277 *et seq.*

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upon as sealed. "The appeal to so mysterious a force is," as *Karl Vogt* remarks, "but a paraphrase of ignorance; it is but one of out of a number of back-doors of which there are not a few in science, and which are always the refuges of those indolent minds that will not take the trouble to investigate anything they do not understand, but are satisfied to marvel at the seeming miracle." Vital force is well compared by Prof. O. Schmidt (Descendenz-Lehre und Darwinismus) to "a ghost, which scarcely knows where to play its pranks."

Ideas on vital force have, in the course of history, passed through the same phases as those of force and matter in natural philosophy, described in the first chapter. While the theory of life in its first phase was completely, and in its second incompletely separated from the conceptions of force and matter, the third or last phase of modern thought has made it clear that there exists an absolute unity or indivisibility of the bodily substance and its vital properties. Life can neither create a new material or a new force, nor destroy an existing one; and if all the conditions were known under which chemical manifestations of life proceed, it would be seen that there is no difference between these activities and those which can be performed outside the body. Each force which the body evolves or loses, comes and goes with the ponderable substance taken in or extruded; the universally recognised eternal principles of the indestructibility of matter and the conservation of energy are absolutely opposed to the notion of peculiar organic force. Here, as everywhere, matter and force are eternal and indestructible.

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We close this chapter with some words, which are as forcible as they are well-founded. They are taken from Prof. Haeckel on vital force, in his work on the "Entwicklungsgang und Aufgabe der Zoologie" (Jena, 1869): "This much at least has been won, that the metaphysical ghost of a so-called *vital force* is banished wholly and for ever not only from the province of human, but also from that of all animal physiology. ' No truly scientific investigation and explanation of vital phenomena can at this day admit this mystic product of dualistic confusion which, now as a designing vital principle, now as a designing final cause, now as an organic creative force, has worked so much error and mischief."

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THE SOUL OF BRUTES.

The intelligence of the brute shews itself in just the same way as that of man. — It is impossible to prove the existence of an *essential* difference between instinct and reason; whatever difference exists is but one of degree.

Krahmer.

The human body is a modified animal form; the soul of man is but an animal soul, raised by involution to a certain power.

Burmeister.

Instinct is a mere empty word, a mere cloak for our ignorance or intellectual indolence.

F. E. Noll.

The notion that animals are incapable of forming ideas, opinions or inferences, runs counter to all the teachings derived from experience.

Czolbe.

The best authorities on physiology and on the subject of animal intelligence are at the present time fairly agreed in that the soul of brutes is not distinguishable in quality, but only in quantity or degree from that of human beings. Man has no absolute superiority over the brute; all his advantages are more or less of a mere comparative nature. There is no intellectual capacity which belongs solely and exclusively to man; it is only the greater strength and the higher development of these capacities, aided

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by their more perfect co-operation, which give him his great and marvellous superiority over the brute. But the reason why these capacities are greater and more developed in man is to be sought partly in the higher and more perfect development of his organ of thought, and partly in the absolute change wrought in the conditions of life by his erect posture, in the different way in which he uses his fore-limbs and in the fact of his possessing articulate speech. But just as it is possible to shew in the physical development of the organ of thought an uninterrupted scale of gradual development from the lowest animal to the highest human being, so a similar ascent of psychical and mental properties in ever rising development may be found in him. Neither morphology, nor chemistry, nor macroscopy, nor microscopy is capable of discovering an essential difference between human and animal brains; great though the differences may be, they are after all but differences of degree. This accounts for the absolute failure that has attended all the attempts made by some scientists even down to our own time, to discover any such characteristic or essential differences, and on the strength of these to assign to man a special place and classification in natural history.*)

In keeping with this, all the well-known physiological or psychological differences, which in all ages have been brought forward as proofs of the existence of an insuperable gulf between men and animals, have appeared on closer investigation to be either non-

*) Consult hereon the Author's work on Man, pp. 101 and 102, and notes 52 and 53 of the second edition; also that on the Darwin'sche Theorie, pp. 189 *et seq.* of the 3rd edition.

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existent, or else to have but a relative instead of an absolute value.*) It has become an axiom among all empirical psychologists and all students of human nature who judge by experience, that the highest mental capabilities of man begin to germinate in very inferior regions, and that the mental activities, abilities, feelings and tendencies of man appear in their primary forms in the animal soul to an almost incredible extent. Love, faithfulness, gratitude, the sense of duty, piety, conscientiousness, friendship and love of one's neighbour, compassion and self-abnegation, the feeling of right and wrong, nay even pride, jealousy, hatred, craftiness, treachery, vindictiveness and inquisitiveness are as well to be found among animals as premeditation, sagacity, the highest degree of cunning, foresight, thought for the future, and so on; nay, the animal shares with man even the *gourmandise* and capacity for progress which are thought to belong to man only. It knows and practises even the institutes or principles of political and social life, of slavery and precedence, of domestic and rural economy, of education, nursing of the sick and medicine; it puts up the most wonderful fabrics in the shape of houses, caves, nests, roads and bridges; animals hold even meetings and joint deliberations, and initiate trials of criminals and culprits; they consult on definite plans and projects by the aid of a well-developed language, consisting of sounds, signs and gestures; they fully remembers the past; they are taught by experience and are, in a word, as much and even more

*) More details on this may be found in the Author's work Man, pp. 153 *et seq.*, note 66—78 of the 2nd edition.

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highly endowed beings than most men know or even dream of.*)

Nought but absolute ignorance and inconceivable supererogation have taught man to designate the undeniable psychical phenomena of animal life as mere "instinct"; a word derived from the Latin *instinguere*, which means "to incite" or "spur on," and therefore presupposes of necessity the existence of a supernatural inciter or instigator. But just the same as there exists neither a vital force, nor a self-contained psychical being, nor an innate idea, so there is no such thing as instinct in the generally accepted meaning of an unconscious, irresistible, unerring, unchangeable impulse of nature or natural tendency, implanted within the souls of animals for their welfare or conservation. All unprejudiced investigators declare themselves most emphatically *opposed* to such a senseless theory, which would make every kind of scientific animal psychology a matter of impossibility. The word "instinct" is, as Dr. *Weinland* says, "obviously nothing more than a makeshift invented by indolence, to relieve us of the difficult task of studying the animal soul"; or, as Lewes remarks, it is "one of those words by which men hide their own ignorance from themselves." The animal is led and guided in its daily life neither by a blind, involuntary impulse, nor by the influence of a

*) The detailed experimental proofs of the above statement may be found in the Author's two works on animal physiology, 1) "Mind in Animals" (63 Fleet St. London, E. C.) and 2) "Liebe und Liebesleben in der Thierwelt," 2nd ed. Th. Thomas, Leipzig. This subject will be yet more fully dealt with in a forthcoming work of the Author's, "Der Mensch in der Thierwelt."

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higher power, but by reflection, arising from comparison, judgment and conclusions, in all of which an essential part is played by the organisation and mental tendency inherited from parents. Even the process of thought through which this is done, is essentially the same as in the case of men, although the power of judgment is very much weaker, and the inherited mental tendency, owing to this lesser power of judgment, comes forward much more conspicuously than it does in man. We might therefore with just as good a right contend that man works only by the impulse of instinct, as trace the actions of animals to that source. But the one is as much a mistake as the other. Both act by understanding or reason *and* by what may be termed instinct, if it be desired to preserve this word as the equivalent of the inherited mental tendencies or faculties of the nervous system; the only difference is that the animal acts *more* by instinct, and man *more* by reflection. The difference is not one of principle, but of degree. There is moreover the sense of *smell*, which, being so much more highly developed in animals than in man, enables the former to perform achievements which seem inexplicable at the first glance, and apparently go to justify the theory of a special innate instinct, whereas a well-instructed person perceives in all this nothing but a simple and natural connection.

"It is the height of folly," says the famous *Système de la Nature*, "to deny intellectual capacities to animals; they feel, think, judge and compare; they choose and deliberate, they have memories, they evince love and hatred, and their senses are often more delicate than our own."

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It is not by instinct, but by reflection, that the fox makes a hole which has two outlets, or has a so-called escape to it, and steals fowls at an hour when he knows that master and servants are away or at meals. It is not instinct, but experience that makes older animals more sagacious and prudent than younger ones; and if, in places where foxes are much hunted, it is found that the young animals, on first coming out, shew greater prudence than in other parts, this is the result of a special tendency to watchfulness inherited from their parents and ancestors. Why do birds that are shot at, such as crows and sparrows, shew no fear of people who carry no guns? and how is it that no fear of man is shewn by animals living in uninhabited islands and having never seen any men and never been chased by them?

Woldemar Schultz, in the account of his Brazilian travels, ("Ausland," 1866, Nr. 24), relates that old mules, who have grown grey in the service of man, often get quite beside themselves at the sight of a packing-case, and kick out at the object of their torture. Others, more cunning than these, allow themselves to be loaded, and then begin to run and jump about, till they have thrown everything off. "It is wonderful," says Schultz, "how the *older* loaded mules during their journeys only choose such paths between rocks and trunks of trees as are far enough apart to let them and their loads through; with this object they will often make considerable *détours*. On the other hand, the *younger* animals are not so particular about it and take no end of trouble in trying to get their loads through narrow passes." Examples illustrating the intelligence and reflective ability of animals are

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as striking as they are well-known; in fact they are so numerous that whole books might be filled with them. Everyone who is in the habit of being with dogs, can tell the most extraordinary and almost incredible facts, shewing their calculating perception and craft.*) It is enough to read the accounts given by *Dujardin* of the intelligence of bees, by *Burdach* of the sagacity of crows, by *Vogt* of dolphins and of

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*) Prof. *Hinrichs* (Das Leben in der Natur u. s. w., 1854) thinks that this animal possesses no imagination or perception, because if it did, it would be able to run about *without its master* and might possibly put up at an inn. Herr Hinrichs can have had no opportunity of observing dogs. Almost every day dogs may be seen running out for walks on their own account, and turning into inns with which they are acquainted. — In reality, there is scarcely any question of natural philosophy in which the unlucky tendency of the philosophic theorist is seen *more* clearly than in this question of the intellectual life of animals. Facts, however cogent, are thrown on one side, and then the time-honoured philosophical categories are brought out with the conceit imparted by that little knowledge which is a dangerous thing, and used to settle the question by applying them to individual cases. Fortunately, Nature knows nothing of the subjective fancies of these learned gentlemen, and in all matters of fact takes no heed whatever of theoretical constructions. Let any one read, for instance, the philosophical disquisitions on the difference between men and animals, in the universally praised and most successful work on "Leib und Seele" first published in 1855 by Herr *Julius Schaller*, a man, by the way, whose handling of the subject contrasts favourably with the method that obtains among scholastic philosophers. In this work the animal is regarded by Herr Schaller as the mere specimen of its kind; man, on the other hand, as an individual and an Ego. What answer could he give, if the whole idea were reversed and it were said: The animal has only a value as a single individual, but man as man and as the representative of his race?

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the remarkable way in which a young dog was educated by an older one. Or we may remember the curious anecdote of a swallow returning in the spring and finding its nest taken possession of by a sparrow, the swallow then seeking to turn the tables on the recalcitrant usurper by beginning to stop up the outled with mud, other swallows assisting it in doing so, until the occupant, thoroughly understanding the fate that awaits it, knocks its beak against and thereby shatters the wall they were building up! Who is not acquainted with the wonderful economy existing among the communities of ants, bees and termites, to which the present author has devoted the greater part of his book on Mind in animals? Who has not read about the canine communities in the North American prairies? or about those political and social habit of the ants which sound so fabulous, but none the less exist in reality — how the ants fight regular battles, undertake marauding expeditions, bring home slaves and train them in their service, keep milchcows in their extensive and well-appointed dwellings, how they practise agriculture, and so on?

Hooker writes of the elephant, an animal that occupies the highest stage of mental development: "The docility of these animals has been known from old, but it loses so much by mere description that their good-nature, obedience and intelligence appeared to me as surprising as if I had never heard or read anything about it. Our elephant was admirable, when not in a wilful humour, and was so docile that at the word of command he would take up a stone and give it to his rider with his trunk over his head, the rider being

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thus spared the trouble of alighting on his geological excursions."

So well known is the stupendous sagacity of the ape — the animal that stands next to man, although man is not directly descended from, but only collaterally related to, the present races of apes — that whole volumes might be filled with the most wonderful and best substantiated accounts of it. The author of this book saw in the Zoological Gardens of Antwerp an ape, who had a perfect bed in his cage, and who would lie down in it at night and cover himself over like a human being. He used to play tricks with hoops and balls that had been given him, and when playing would turn towards the spectators, as though he wanted to talk to them and shew to them what he could do. This same ape had been observed to trace with his finger the outline of his shadow on the wall. The whole phenomenon produced a painful impression, as though a human-like, reflecting and sensitive being were shut up there in a cage. On the other hand, the negro, according to the excellent description given by *Burmeister*, strikingly resembles the ape both intellectually and physically. There is the same imitativeness and the same cowardice, there are, in point of fact, the same characteristic peculiarities. Historically, as in Haïti, the negro appears, to borrow a phrase from a writer in the Allgemeine Zeitung, "half tiger, and half ape." The *aborigines of Brazil* are described by *Burmeister* as animals in their ways and habits and as lacking every higher mental capacity. "In the deserts of the interior of *Borneo* and *Sumatra* and in the Polynesian islands," says *Hope*, (Essay on the Origin of Man, 1831)

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"hordes of savages wander about, whose resemblance to the *baboon* is unmistakable, and whose superiority in mind and body over the irrational animal is scarcely perceptible. They have little memory, and still less power of imagination. They seem incapable of reflecting on the past and of providing for the future. Nothing stirs them up from their apathy except hunger. There is no mental faculty discoverable in them except the low animal cunning usually ascribed to the apes."*)

It is often alleged that the possession of *speech* implies so characteristic a difference between man and brute, as to leave no doubt about the existence of a deep and impassable gulf between them. Those who urge this plea must necessarily be ignorant of the fact that animals can speak, and that they possess in a high degree the power of mutual communication, even about concrete matters. "How is it possible to pretend," says *Broca*, "that man only possesses the faculty of speech, and that it is wanting in animals? People must be blind not to see that animals are able to communicate their thoughts to each other, by means which, though they may differ ever so much from those employed by men, represent none the less speech in its various forms."

Dujardin placed a saucer with some sugar in it in a hole in a wall, at some distance from a bee-hive. One bee having discovered this treasure, impressed the

*) On ape-intelligence on the one hand, and on the low intellectual condition of the wildest savages on the other, see the detailed notes 66 and 67 of the Appendix to the Author's work on Man. And does not a cretin, who is yet a human being, stand below the brute in mental ability?

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nature of the locality on its memory by flying around the edges of the hole and pushing against them with its head; it then flew away, and after a little time returned in company of a number of its friends, who quickly made off with the sugar. Had not these animals spoken to each other? How many examples prove that birds especially make very circumstantial communications to each other, that they agree a certain plans, hold councils, and put criminals on their trial? The way in which the *chamois* set their watches and apprize one another of the approaching danger, is a very plain illustration of this power of communication. And can this prudence have been acquired by instinct, seeing that chamois-hunters are not as old as chamois? Many gregarious animals choose for themselves a leader and willingly place themselves under his orders. Can this be done without mutual communication? The way in which dogs, wolves and foxes carry on their prowling expeditions on a premeditated plan, clearly proves that a very definite conversation, which is possible only by an interchange of speech, must have previously taken place between the individual members of the pack. But as man does not understand the language of animals, he prefers to deny the existence of it altogether.

Parkyns, an English traveller in *Abyssinia*, devoted his leisure for a long time to the observation of the habits of apes and thence concluded "that they have a language as intelligible to them as ours is to us." (*Revue Britannique.*) "The apes," says Parkyns, "have leaders, whom they obey more faithfully than men usually do theirs, and they have also a regular system of depredation. When a tribe leaves the rocky

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clefts and descends into the plains to rob a cornfield, it carries along with it all its members, old and young, male and female. The elders of the tribe who are easily recognisable by their hirsute appearance, are chosen as outposts. Prior to descending, they carefully explore every ravine and climb up all the rocks to obtain a good survey of the district. Sentinels are also placed on the flanks and in the rear; and the watchfulness of these is most remarkable. From time to time they call and reply to each other, to announce whether any danger threatens, or whether all's right. Their cries are so strident, so varied and so distinct, that in course of time they may be understood by listeners. At the least shout of alarm the whole tribe comes to a standstill and hearkens, until a second cry, differently intoned, bids them march on."

According to the observations made by what are called puntsmen in England, wild ducks hold regular parliaments and go to regular divisions. The ordinary puntsman does not understand much more of their language than the cries of warning and of safety, whereas they, like all animals, have special expressions for pleasure, pain, hunger, love, anguish and jealousy. The experienced puntsman, on the other hand, knows when the birds are talking of departure, rest, danger, security, love, anger, and so on. Each kind, again, has its own tongue. Prior to the usual morning flight there is always a very loud and lively discussion, lasting from ten to twenty minutes, at the end of which they all fly off. — It has been told of a brooding grose, who was ill, that she went to another and cackled to her, whereupon the other went with

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her and undertook the work of hatching. The sick one sat down near and died an hour later. — *F. W. Gruner* reports that the fox has very decided inflections and tones in his voice. The dog barks differently in joy from what he does in anger and gives a special expression of his voice to each of his feelings. This is true of almost all our domestic animals, who know how to make themselves very well understood to those around them by the tone of their voices. Each animal has its own language, with a number of definite sounds to express its wishes, needs and emotions.*) The gesture and vocal language of insects (bees, ants, beetles, etc.), consisting in touch and pressure with the antennæ. in tapping, chirping, rubbing of the wing-cases, and so on, is known to be a very wealthy and well-developed one.

An observer has lately recorded that he was present once in springtime at a remarkable council, held by swallows. A pair of swallows had begun to build their nest under the roof of a house. One day a number of other swallows came, and a long discussion took place between them and the builders of the nest. They all sat together on the roof near the nest in course of construction, twittering and vociferating as loud as ever they could. After this consultation had lasted for some time, and the nest had repeatedly been inspected by several of the flight, the meeting broke up. The result was that the couple deserted the nest they had commenced, and began building a new one in another part of the rafters situated more favorably.

*) Particulars of this may be found in note 98 of the Appendix to the Author's work on Man.

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In Bodenstedt's "Tägliche Rundschau," Dr. *Julius Hensel* relates a very similar anecdote. In September, 1864, he saw in the Hanoverian town of Osterode a young swallow hanging on the weathercock of the church tower, having been wedged in on attempting rather too bold a flight. Flocks of swallows were vainly endeavouring to succour their comrade, whose life hung on a thread. On the following morning, when the little thing had long been dead, such numbers of swallows circled round the dangerous pinnacle that the air was black with them. The news had been communicated from one to another, and they had come to take stock of the case, in order to avoid the danger for the future. Two hours later the whole assemblage had dispersed.

Nearly every one has noticed the remarkable gatherings which birds of passage are in the habit of holding in certain places, one or more days before setting out on their journey; at these meetings the plan and arrangements for the journey are decided on by joint deliberations. Far more complicated must be the consultations held by many birds, as for instance by storks, in connection with the trial of culprits, especially of those who have been guilty of infringing the law of monogamy, which are very strictly enforced among many birds. The author in his work on the "Leben der Liebe in der Thierwelt" (Erotic life in the animal world), p. 69 *et seq.* has given full details of these "trials at law," as well as of the marriages of birds.

No doubt, some will say, animals may have a language, but it is not capable of development. This is one more of those contentions which are entirely

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disproved by reality. Apart from the fact that we neither know nor can know anything definite as to the possible or actual development of animal language, since we do not understand it, there are a number of facts and observations extant which go a long way to shew that the language of birds, as represented by the voice, the same as that embodied in gestures and mimics, is undoubtedly capable of a certain development and improvement. According to *Fuchs* (Das Seelenleben der Thiere, 1854) there is an essential difference between the sounds uttered by *wild* and those uttered by *domesticated* animals. The development of the language of birds artificially trained to or imitating speech, such as parrots, is so well known that it need only be cursorily referred to in this place. And if, in this connection, we glance at man, we must ask the question, What development is the language of those savage races capable of, of whom travellers tell us, that they speak more by signs and gestures than by sounds, and that even their sounds resemble rather the rough cries and croakings of animals than human articulate speech.*)

We know further that the mental capacities of the animal can be formed and brought out like those of men, as is sufficiently proved by the often marvellous results of training. That the education of animals proceeds slowly and painfully is owing less to their want of ability than to the difficulty of communicating with them. In this the same means have to be employed — and in fact are employed — as

*) Compare note 78 of the Appendix to the Author's work on Man.

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are called for in the troublesome education of the deaf and dumb. But even without special training all domestic and tame animals, by continual intercourse with man, are well known to be more highly trained intellectually and to shew more capacity than in their state of nature. Thus our house-dogs are evolved from wolves and jackals, and have not only improved most remarkably in intelligence, but have also acquired moral characteristics, such as affection, conscientiousness, fidelity, sympathy, dutifulness, temper, etc. But even in the state of nature most animals change and improve in proportion to the change in their surroundings, needs, habits, the fashion of their dwellings, etc. It must be admitted that as a rule these changes proceed so slowly, that they more or less escape our notice. An exception to this rule is made by the nidification of the common *house-swallow,* as to which *F. A. Pouchet* (Actes du Museum d'histoire naturelle de Rouen, tome III, 1872) has proved by direct comparison that in the course of the last forty or fifty years it has undergone a marked improvement, whereby more room has been acquired for the young, as well as a better protection against rain and enemies. The same observer states that the European yellow-hammer hangs its nest under the boughs of trees by the help of gathered pieces of twine and thread; the utilisation of these materials has only become possible since the existence of the manufacturing activity of man. "He who says," proceed *M. Pouchet,* "that animals are mere unchangeable machines, shews that he has never observed any of them. If they are only machines, the most superficial observation of the smallest among them proves that

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these machines observe, compare and judge, or, in other words, that they possess all the faculties of reason."

That the reason of man alone is capable of training and progress by virtue of an interior or spontaneous tendency, while the intelligence of animals would for ever remain *stationary* without the stimulus imparted to it by man, is a contention which (as proved by the examples already mentioned) is neither perfectly accurate, nor in any way fitted to form an essential difference between the minds of animals and men. For it is well known that the reason of the lowest races of mankind does not manifest this internal tendency, and that there is no personal or independent history of the civilisation of those races; even the human race, considered as a whole, has, as we have already shewn, needed immeasurable spaces of time in comparison with the historic period, in order to acquire this tendency.

That a gradual transition, passing through countless intermediate gradations, exists between man and animals, both in mental and corporeal characteristics, can only be denied by those who insist upon setting their own opinion *above* facts. All the well-known marks of distinction which have been put forward with the view of establishing a sharp line of demarcation, are, as we have repeatedly remarked, but relative and not absolute in their nature.*) And how

*) In the comparison so often instituted *between men and animals* the blunder is always made of placing the civilised European and some wild and barely known animal in juxtaposition; the correct way of drawing a parallel would be by examining the extreme borders of humanity and the transitional stages. Prof.

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could it be otherwise? Nature is one whole thing, spreading in every direction in an unbroken interdependence and knowing of no absolute boundaries and divisions; for lines of demarcations have only been set up by the systematizing human intellect. Man has, therefore, no right to set himself above the rest of the organic world, and to consider himself as a being of a *distinct* and *higher* nature: on the contrary, he should recognise the firm and indissoluble couplings, which tie him to nature. His beginnings and his endings are identical to those of everything else that lives and grows.

"The old view," says the author of "Menschen und Dinge, Mittheilungen aus dem Tagebuche eines reisenden Naturforschers, 1855," "that man alone is endowed with reason and intellect, and that between him and the animals there exists an impassable gulf, has not a little contributed to hiding from us for such a long time and so completely the psychological aspect

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Kölliker, in his above-mentioned work on the Darwinian theory, makes the following strictures on this fallacious method: — "If the civilised Indo-European is compared with the highest mammalian brute, the gap is found great not only intellectually, but also physically, and a horror is then felt of the idea that man and certain animals, such as the higher apes, should stand in any genetic relationship. But if we take the red prognathous New-Hollander or Bushman, whose body may almost be termed brute-like, and whose intellectual life is of the lowest grade, the gap appears by no means so great, and the comparison and juxtaposition of such a creature with ourselves is by no means flattering. *And who can assure us that the anthropoid apes now known, such as the gorilla, chimpanzee and ourang, were really the mammals most like the human race which have existed, or that in earlier times there were not men more savage and lower than are known at this day?*"

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of the animal world . . . When this error has once been cast aside . . . and when the idea shall once have prevailed that not only from a physical, but also from a moral and intellectual point of view, *the animal world is a man in fragments,* then a comparative psychology will arise as a parallel to the comparative anatomy which we have gradually formed.

Fr. Friedrich remarks very forcibly and cogently: — "Not to recognise the position which animals occupy towards man and in the great whole of Nature is at the present day a sign of injustice and obtuseness. He who denies their intellectual and psychical qualities, shews that his understanding of Nature reaches no further than the range of his physical vision, and that he is unqualified to give a judgment on intellectual powers."

Professor *B. Cotta* relates a remarkable incident, first observed by *Darwin,* about a species of crabs inhabiting the Keeling Islands. These crabs open cocoa-nuts in a peculiar fashion with their curiously formed claws, and having done so, eat the kernels. This proceeding is urged in favour of the theory of a special innate instinct, and the teller of the story seems inclined to perceive in the method referred to a particular proof of the supreme wisdom of the creator, who must have formed for this special object an animal fitted for it! It is difficult to conceive how a naturalist can come to such a conclusion, and the irrationality of this way of looking at things has already been partly exposed. It cannot be doubted that the animal had tried *experiments* in the matter and specially in cocoa-nuts, before it arrived at the idea of using its claws in that fashion, and that the complete evolution of the

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now existing conditions came about finally by *natural selection*. To see anything else in it, and to imagine that that crab was made a present of its peculiar claw-apparatus in order that it might crack cocoa-nuts, is a manifest absurdity. We might as well say that noses existed for the sake of spectacles, or that man being created in order that he might travel on railways, built locomotives by instinct and received legs in order that he might step into the carriages.

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FREE WILL.

Man is as free as a bird in a cage; he can move within certain limits.

Lavater.

There is no such thing as a free will or voluntary act, independent of the totality of the influences which in each individual moment guide men and keep even the strongest within bounds.

Moleschott.

How foolish is the idle conceit of an absolute freedom of the human will, seeing that it is completely ruled by the tendencies to self-preservation which Nature has implanted in the human bosom.

A. H. Schneider.

To understand all is to pardon all.

Mme de Staël.

Since man, as we have proved in the foregoing chapters, is a product of all-creating Nature, both in his physical and his psychical being, there can be no doubt that not only what he is, but also what he wants, does, feels and thinks, depends on purely natural interconnections and on necessities of nature, like the whole fabric of the universe. None but a superficial and ignorant contemplation of man and of human existence, superadded to spiritualistic and metaphysical prejudices, could ever induce the idea that the actions

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either of an individual or of nations are the outcome and expression of a perfectly free and self-conscious will. On the contrary, if we go to greater depths in our searches, we are taught that the connection of the general definiteness of nature and of natural influences with individual idiosyncrasy is so close and infrangible that we can only speak of volition and free decision in a very limited sense; we are taught of settled laws and rules in all the phenomena which we have hitherto looked upon as the products of mere chance or of self-acting spontaneity. "The human freedom, of which all boast," says the great thinker *Spinoza*, "consists in nought but that men are conscious of their own will, while ignorant of the causes which have induced it."

The science of *statistics*, which has only been turned to proper account in modern times, has the great honour of having proved the existence of definite rules in a number of phenomena, which had hitherto been looked upon as purely accidental or as owing their origin to an arbitrary power. If, for instance, statistics prove that under identically the same circumstances almost the same number of murders, of suicides, of thefts, or of marriages, take place within a certain time, we cannot but feel compelled to substitute a rule of some kind of natural predetermination for the apparently accidental or arbitrary nature of such acts.

It is only in concentrating our attention upon individual and minor facts that we are apt to lose our hold on the major ones by which we may recognise this rule, while only an aggregate survey of Nature and its phenomena enables us to understand the order of things which, in a measure, inexorably

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sways humanity and man. And thus it may be said without exaggeration that in the perennial contention about the freedom of the human will, the vast majority of doctors and practical psychologists lean to the side of those who recognize that all human actions are everywhere dependent in the last resort on the fixed necessities of nature or on external and internal influences, and that in each individual instance there remains only a very small scope, and oftentimes no scope at all, for free volition.

It is impossible for us to deal in this place exhaustively with the great truth just referred to, which is so necessary to the recognition of the existence of a natural order of things in the Universe; for if we wanted to do so, we should have to take in almost the whole range of human knowledge and thought. We must, therefore, confine ourselves to referring to certain leading points by which the possibility of such demonstration may be readily perceived.

There are three main groups of influences which more or less control the will of man, and which set certain definite limits to his actions.

The first and most powerful of these influences resides in the individual organisation of each person, and in his physical and moral tendencies, impulses, inclinations, and characteristics which are mostly inherited from parents and ancestors; these are forces which, according to experience, work so powerfully on man's actions that little or no room is left for free choice.

The second influence is the force of training, education and example, acting upon the innate character, and producing thereon sometimes a beneficial, and

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sometimes a deleterious effect, but in each instance reducing man's free choice to its narrowest limits.

The third influence lies in the external circumstances of life and in the action of the surroundings or media within which each individual man does and must move. In the most superficial sense we reckon among these media: country, climate, natural conditions in general, also manners and customs, social and political circumstances, stages of civilisation and knowledge, peculiarities of character, the style of feeding and living in use among the people, nation or race to which the individual belongs; lastly, the special personal circumstances by which everyone living in the midst of a community is affected in the same way as he is by general circumstances. These are: health, nutrition, wealth or poverty, abundance or privation, social position, happiness or misery, and so on.

Galton (London Journal of the Royal Geogr. Soc., vol. XXII) relates: "The difference of the moral character and the physical constitution of the various tribes of South Africa is connected with the nature, soil and vegetation of their dwelling places. The arid inland steppes, that are covered only with thick jungles and low brushwood, breed dwarfish sinewy Bushmen: in the open, hilly, undulating pasture land we find the Dammaras, a nation of independent shepherds, amongst whom each head of a family is lord paramount within his own circle; on the rich crown-land of the north, on the contrary, we meet with the most civilised and progressive race, the Ovampos." According to *Desor*, the histories, customs, and manners of the American Indian tribes, whom he distinguishes

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as *Prairie* and *Forest* Indians, may be easily traced back to the differences existing between the various descriptions of soil they inhabit. The desert, to quote *Karl Müller's* expression, has changed the Bedouin who inhabits it, to a "cat," and according to general *Daumas*, the motto of these faithless dwellers of the desert is: "Kiss the dog on his mouth, till you have got what you want of him." In their arid and sandy home, which never yielded them anything but a bare existence, the *Arabs* have ever remained a crude, uncivilised people, no better than migratory savages. But look at the change that was wrought in them, when they had conquered Persia, Spain and India! And what a difference in breeding and national character is perceptible between the rich lands of the Nile, the seat of a civilisation as ancient as it is wonderful, and the desert immediately adjacent thereto! Again, some two or three hundred years ago, the first colonists reached New England, true Englishmen in every respect; but what a change has come over them since then, by the mere influence of changed soil and climate! Spareness of body, and dry yellow skin, long straight hair, long necks and elongation of all long bones, especially of those of the upper extremities, together with less development of the glandular system, deep-set eyes, and so on, make the Yankee as a rule distinguishable at a glance from the natural born Englishman. Perhaps the restless and almost feverish excitability of his character and habits, which partially accounts for the rapid and gigantic growth of the American commonwealth, is in some way connected with the excessive dryness of the air; and it has also been noticed that during the prevalence of the north-

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westerly winds, which lose all their dampness on their passage through the vast American continent, the irritability of the inhabitants of America is strikingly on the increase. But even more striking than the changes just mentioned are those undergone by the English in Australia, more particularly in New South Wales. The character of the native Britain bears impressed upon it his damp, cloudy sky, the heavy atmosphere and insularity of his home, while on the other hand the very character of the Italian beams, as it were, with the rays of his glowing sun and is marked with the impress of his ever blue sky. The Oriental's world of phantastic thoughts and fables is in a measure the outcome of the luxuriant and exuberant fulness of the nature that surrounds him. In countries in which earthquakes, wild beasts, hurricanes, storms, insecurity of life, of health and of wealth and like circumstances react upon the character of the inhabitants, superstition and want of courage are rife, and the imagination is developed to an excess at the cost of the intellect. Conversely, in the Far North, in which all nature seems congealed by cold blasts adding to the chill and torpor of an icy atmosphere, which seems more fit to destroy than to create life, we find but scanty bushes, dwarfed trees, and a diminutive race of men barely adapted for civilisation. Only where climate, soil, and the external conditions of the earth's surface keep up a certain medium or equilibrium, as they do in Europe, can man rise to that stage of intellectual and moral civilisation, which gives to the European so great a superiority over all the other races of the globe.

The French scientist *Trémaux* (Revue contemp.

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1864, pp. 381—384) quotes numerous examples taken from popular traditions, and going to shew that apart from the influence of climate, quite a definite relation exists between the geological formation of the soil and the character and mental type of the nations dwelling thereon. The inferior race, says *M. Trémaux*, always belongs to the older formations and the less favored climate, whereas the superior race always inhabits a land which has undergone a greater change in a comparatively narrow space and consequently belongs to the more recent formations. If a people (or an animal) come to live in another country and under other conditions of life, it changes for the better if the new soil be more recent, and for the worse if it be more ancient, than the one they originally lived on. A new soil breeds a new being or a new species — that is the *rationale* of M. Trémaux's investigations.*)

No less than soil and climate, do political and social conditions exert a powerful influence on the character, and thence on the actions, of nations as well as individuals; of this, history and popular traditions afford us countless examples. When ruled by despotism, as in so many Eastern countries, men become hypocritical, submissive slaves, destitute of sense of honour and dignity, who do everything to please their rulers; while in a Republic or a free

*) For further information on the influence of the environment (soil, climate, etc.) on Man see *A. von Humboldt*, "Ansichten der Natur"; *O. Uhle* in the journal "Natur," 1874, Feb. to March; *Buckle*, "History of Civilisation in England," Introduction; *Cabanis*, "Sur les supports du physique et du moral de l'homme," 1798 till 1815.

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State they learn to respect themselves, and develop virtues to which they were previously strangers. The same Romans who, in the days of the Republic, exhibited such great Republican virtues and such an exemplary sense of modesty and decorum, actually gloried, in the days of the Empire, in being permitted to offer their wives and daughters to the lusts of their ruler and of his creatures, and Rome became a place full of nauseous vice and fetid depravity. Great and stirring times breed numbers of great men and wonderful characters who fill history with their fame; whilst in petty, stagnant periods every spirit seems dead, and every noble action impossible.

Now just as nations as a whole are dependent for their history and characteristics on the external conditions of Nature and the internal ones of Society under which they have grown up, thus is the individual man no less a product and a sum total of external and internal natural forces, not merely in his entire physical and moral being, but also in each single department of his activity. This activity depends first and foremost on his whole mental individuality and special characteristics. But what is this individuality which acts so decisively on man, and in each single instance, quite apart from additional external forces, fixes his line of conduct within such narrow bounds as only to leave an exceedingly small scope for the exercise of his free will? what is this individuality but the necessary product of innate physical and mental qualities, in connection with training, teaching, example, custom, rank, fortune, sex, nationality, climate, soil, conditions of time and of living, and so on? Man is subject to the same law as every plant

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and every animal — a law, with the clearly defined features of which we have already met in the primitive world. As the plant depends for its existence, its size, form and beauty upon the ground in which it is are rooted; as the animal, great or small or large, wild or domesticated, beautiful or hideous, is the creature of the external conditions under which it has grown up; as an entozoön ever changes as it passes into the interior of another animal; thus each man is no less a product of similar external circumstances, accidents, and arrangements, and can therefore by no means be set down as such a mentally independent being endowed with a free will, as moralists and philosophers are in the habit of representing him. He who brings with him into the world an innate tendency to benevolence, compassion, conscientiousness, love of justice, and so on, is in most instances cut out for a good moralist, supposing that bad training or adverse conditions of life do not forcibly subdue that tendency; whilst on the other hand a congenital proclivity to melancholy, or indolence, or frivolity, or vanity, or arrogance, or avarice, or sensuality, or intemperance, or gambling, or violence, can, as a rule, be neither controlled nor checked by any kind of will or imagination. In point of fact, daily experience proves conclusively that each person generally acts in the manner most suited to his nature and individual character; these inborn or inherited tendencies and leanings of our nature mostly exercise over our resolutions and actions an influence in comparison with which all other motives, especially those of reflection or religious belief, recede more or less into the background. "The actions of men," says *Auerbach's*

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Baumann, "are independent of what they believe about God; they are only prompted by inward inspirations or habits."

How often does it happen that a man knows himself and his mental and peculiar characteristics sufficiently well to see what faults he is likely to commit, and yet is unable to successfully resist this internal pressure. He repeats the same faults over and over again and gets again and again into the same scrapes; for it is quite an exception for the powers of imagination and thought to gain the victory over a man's perceptive faculties and appetites. The youthful man or the sensualist, as a rule, sacrifices everything to his erotic passion, the older man or the covetous and avaricious character panders only to his acquisitiveness; the sluggard is only prompted by his inertia and his dislike of work, the ambitious man by his desire for honour and distinction; a mother by the love of her children, and so on. The miser who has already amassed millions, still goes on hoarding to his dying day, knowing all the while that his heaped-up wealth will benefit neither himself nor others. Innate passion is deaf to all reasoning; it listens to no rational arguments, and forgets every danger and every consideration. No man can master inborn timidity or nervousness by the mere power of this will, and inherited irresoluteness or weakness of decision may become the grave of the most promising resolutions and actions. A man of a violent temper, while in a rage, commits acts of which he would deem himself incapable in quieter moments. A compassionate and good-natured man sacrifices himself and his own interest for the good of others, while no impassioned

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pleadings, no scenes of misery, and no horrors of hell can move the spirit of the hard-hearted. Vanity, love of approbation or desire of fame may become the cause of the greatest crimes or the most preposterous actions, but according to circumstances they may also lead to the noblest fruits of life.

All these qualities, tendencies or propensities, which are sometimes inherited and sometimes acquired, are so powerful in human nature, that, as we remarked heretofore, reflexion can form but a small check upon them, and religion scarcely any. We always notice that man delights most and encounters least difficulty in following his nature, or the path which to him seems the pleasantest. We help a sufferer, not because the laws of morality command it, but because we are prompted to do so by compassion or because we instinctively put ourselves in the place of the sufferer, and do to him what in a parallel case we should ask or expect others to do for us. "Good," says *L. Feuerbach*, "is that which is agreeable and suited to man; bad or evil is that which clashes with his nature."

But not only does man's intrinsic nature, as a rule, tell him how he is to act, not only are his actions the necessary outcome of his whole individuality, but in every single moment, and in each individual act, powerful influences of nature are at play which shorten, as it were, the tether of his free-will. Who does not know how powerfully atmospheric influences act on our ordinary mental disposition, and thence on our resolves, and where is the man who has not made such an observation on himself? Our resolves vary with the barometer, and a number of things which

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we think we have done by free will, were perhaps only the result of accidental or transitory influences. Personal physical conditions also exercise an almost irresistible influence on our mental disposition and resolutions. "The young man," says *Krahmer*, "has other ideas than the old; a man in a recumbent position thinks differently from one standing up; the hungry man looks at things in a different light from the full one, and the man in a comfortable frame of mind takes very different views from one who is irritated and sulky." The vast influences which may be, and in fact are, exercised on human thoughts and actions by the manifold sufferings of the various bodily organs are too generally known to require mentioning in this place, especially as they have been to some extent dealt with in an earlier chapter. Times out of number have the most horrible crimes been called forth by such abnormal bodily conditions, and without the will of the perpetrator. Not until our own days has science commenced to cast a piercing glance into the hidden recesses of these remarkable conditions, and looked for a state of disease in cases in which heretofore no doubt had been entertained of the presence of free-will.

Thus, no one who looks deeper into things can deny that if there be a free will in man, it can, both in theory and in practice, exist only within very narrow limits, and that, as the anonymous author of the admirable work on the idea of God (Nördlingen, 1856) remarks, "our whole life, like our whole organism, is a compound of necessity and freedom." Man is free, but his hands are bound. He cannot go beyond a definite boundary set by Nature, while within

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this boundary represented by natural laws, he doubtless enjoys sufficient free scope so long as more sensible views get the better of less sensible ones, or reason and reflection gain the day in their struggle with innate or accustomed tendencies and appetites, or mere impulses of the moment. The more highly a man is intellectually developed and trained, the stronger is his will and the greater his responsibility. On the contrary, his responsibility becomes less in proportion as the power of reason and reflection is less able to contend against the base or involuntary tendencies of the human soul. Hence the vast majority of those who offend against the laws of the State and of Society, ought to be looked upon rather as unfortunates who deserve pity than as objects of execration. It is in evidence that by far the greatest number of all crimes against the State or against Society may be traced to passion or ignorance, being the outcome of want of education or of weakness of the reflective faculties. The educated man finds means and ways of meeting an unendurable condition and of getting out of its way, without coming into conflict with the existing law; the uneducated knows not how to help himself except by crime; he is the victim of the circumstances in which he is placed. What is the good of free will to him who, from necessity or acting under the impulse of the irresistible tendency of self-preservation, lies, steals, robs, and murders? To what extent can a man be held accountable for his actions whose destructiveness and whose leaning towards cruelty are great, while his powers of reason are small? Want of understanding, poverty, and want of education, these are the three principal sources from

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which crime springs. The philosopher *Plato* was in his time keen-sighted enough to say: "Crime has its foundation in the want of education, and in the bad training and arrangements of the State." And the able author of the "Principles of Social Science" quoted heretofore remarks: — "Neither in crime nor in madness is there anything strange or extraordinary. Both arise from settled and definite causes, which are just as accessible to our investigation as the laws of natural philosophy, except that the human mind is harder to understand, on account of its greater complexity .... It is a truth that each one of us would become criminal or mad, if he were placed in conditions favourable thereto."

That the juxtaposition of crime and madness implied in these words rests on no exaggeration, is proved by many recent medical researches. These researches have proved in the case of many criminals, if not of all, that from the very first they had been, as it were, doomed or predestined to crime by a faulty or imperfect organisation of mind and body. The researches of *Saure* ("Ann. méd. psych.") on the causes of mental derangements in prisons, shew that there exists the greatest analogy between insane persons and a certain class of prisoners, consisting of persons of imperfect organisation; according to him a portion of the inmates of prisons ought rather to be placed in *lunatic asylums!* According to the same authority, the number of lunatics convicted by criminal courts is very large, even in this nineteenth century of ours. Professor *Benedikt* of Vienna has arrived at a similar result; having had an opportunity of studying the formation of the brain of a number of persons convicted of very

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serious crimes, pronounces it to have been defective in every one of them. More especially were the important convolutions of the surface of the brain developed to a strikingly diminutive degree, and the posterior cerebral lobes, the seat of emotion and of moral sensitiveness, were so deficient in development and so dwarfed as actually to leave part of the cerebellum bare. Professor *Benedikt* holds madness and crime to be twins, and is of opinion that no criminal acts to more than a very limited extent from his own moral freedom and self-control. (Bericht über die Naturforscher-Versammlung in Graz, 1875.)

The same conclusion has been arrived at by Dr. *Bordier* of Paris. Having examined the brains of 36 executed criminals, he found that in almost all of them the parietal lobes were excessively developed at the cost of the frontal, a fact, which points to a low grade of intelligence together with a stronger tendency to violence. This is also the general condition of the brains of pre-historic men, so that its occurrence at the present day may be regarded in each instance as a case of atavism or individual reversion to the state of former barbarism. Perfectly normal brains, according to the observer referred to, are very rare among criminals. In most of them are found asymmetry, prematurely ossified sutures, remains of old inflammation of the cerebral envelopes, an excessive fulness of blood in the vessels of the vertex of the cranium, and so on.

Among the most recent researches of this subject are those of Dr. *Flesch* (Untersuchungen über Verbrecher-Gehirne, Würzburg, 1882), who has come to conclusions which make the behaviour of these

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unfortunates appear to us in a light very different from that in which it is usual to regard criminal actions. All the facts brought to light go to shew that many criminals are simply unfortunates, afflicted with insanity, partly in an incipient and partly in an acute state of development.

"Hence," says *G. Forster*, "we should do best in neither judging nor condemning anyone." And hence also in a few centuries, when men shall have grown better, wiser and happier than they are at present, will they look back on the criminal trials of the present time with feelings akin to those with which we regard the trials for witchcraft and the inquisition of the Middle Ages.*)

*) Consult on the question treated in this chapter the Author's Essay on "Wille und Naturgesetz" in his work, "Aus Natur und Wissenschaft." Also the details given on pp. 75 *et seq.* of his pamphlet, "Die Macht der Vererbung."

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MORALITY.

The death of dogmas is the birth of morality.

Kant.

When will the time come that men shall learn to see that the sources of the noblest and most elevated actions of which we are capable, have nothing to do with the ideas we may hold about God, about life after death, and about the realm of spirits?

G. Forster.

Loving man is the only true way of living of God.

L. Feuerbach.

And how about morality? This is the cry that is already dinned into our mental ears by an army of moralists, who, after trying to follow our argument up to the last point referred to, are now ready to swoop down with all the theological and philosophical appliances and means supplied by their well appointed arsenal, upon our position which, in their estimation, must, upon higher grounds, be considered untenable. Aye, how about morality indeed? What is the meaning of the ideas of virtue and vice if there be no supreme and supernatural powers, no heavenly judge and avenger, no God, no redemption and no future life, but only a blind, inexorable necessity of nature? What is henceforth to control the actions of men? Do not such

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principles and theories lead to a dissolution of all political and social order, and to a *bellum omnium contra omnes,* a war of all against all, in which none but wanton egotism or self-interest will be appealed to in the last resort? And along with these, a whole array of other similar stereotyped phrases has always been thrown in the teeth of those who ventured upon attacking time-honoured prejudices, which by their very age had gained an iron grasp on mankind at large.

The author of this work might well save himself the trouble or the duty of answering such questions, and might declare himself unable to see what moral consequences can or must be entailed by a theory of the life of the world, which is based on the existence of a natural order of things. If his theories be right and consonant with truth, they must be admitted, no matter what results may ensue thereform; for truth stands, as no one can seriously dispute high above all considerations of morality or utility, and cannot be denied, be the consequences as fatal as ever they may.

Again, in speaking to those who contend that he destroys everything by his criticism but offers no compensation, the author might confine himself to repeating the admirable answer made by *Voltaire* to those who found fault with him on a similar occasion: "What? I have delivered you from the jaws of a wild beast that was devouring you, and you ask me what I will give you in its place!" In just the same way might the author reply to his critics: "What? I have delivered you, so far as the present state of science and the weakness of human

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knowledge permit me to do so, from the two greatest and most dangerous enemies of humanity, viz. ignorance and superstition; and you ask me what I mean to put in their place? Do not trouble yourselves about that, but leave truth and science to take care of themselves; both, as has been shown by experience thousands of times, have never done man any harm, but only good. What they destroy or break down on the one hand, they restore on the other a hundredfold. Besides, it is in no wise conceivable how a fictitious happiness should in the long run give man peace, whilst truth, though at times painful, carries her own remedy with her."

Such an answer would embrace everything that requires to be said, looking at things from the standpoint of the author and of his work. Nevertheless, he does not mean to cast the *onus probandi* from his shoulders altogether, but is fully prepared to substantiate the theory propounded by him, according to which morality and the moral law have nothing to do with the ideas that men are in the habit of forming of things supernatural, but that, on the contrary, the moral law can pitch its tents quite as well, if not better, on the new territory of a natural order of the universe left open by science, than on the old one of religion and of belief in spirits. If morality, or the ethical customs and precepts by which we are guided, be such as could not exist without religious or ecclesiastical coercion, then all we can say is that they are worthless and ought to make room for better ones. But in reality it is a fact that has long been placed beyond all doubt, that morality and the church, nay morality and religion, are things perfectly indepen-

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dent of each other, and that the most efficient agencies of morality in the world are education, training, prosperity and freedom.

For morality, as has been shewn in a previous chapter, is not innate or implanted by a higher power in the mind of each individual in the form of definite moral precepts, but it is acquired by long practice and experience. If it had been implanted, or, in other words, if man, as an outcome of the Godhead, possessed an innate knowledge of good and were impelled towards it, as Idealists and theologians want to make us believe, then we might dispense entirely or to a very large extent with all other premiums that are held out for being moral — such as the prospect of future rewards and punishments, as well as the arrangements made by Society for the prevention and punishment of crimes.

Nor is morality the outcome of religion or of definite precepts derived from faith; for experience has proved that the most religious ages and nations have not always been the most moral. On the contrary, religious fanaticism has such an array of sins of commission and of omission to answer for, that all other offences that history tells us of, are a mere nothing in comparison with them. Is it not a fact that in the very countries in which the Church holds an undisputed sway and no freedom of thought is tolerated, a very much lower standard of morality prevails to this day than in those in which enlightenment has raised its victorious banner? We know moreover that in the atheistic religious systems of a Buddha or a Confucius the purest and most unalloyed morality was preached, despite their atheism,

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and that unbelief is by no means synonymous with immorality. On the contrary, often enough religion and immorality go hand in hand, particularly in countries in which the priest's absolution lightens the criminal's offence, while atheists and unbelievers are oftentimes the most moral of men! How many philosophers of antiquity believed in no reward after death, and yet evolved from their teachings such maxims of morality as called forth the admiration of their contemporaries and of posterity alike!

So far from morality being incompatible with unbelief, it is like everything that man possesses, the outcome of a long series of acquirements handed down from generation to generation, and depends on definite natural and social conditions; it is therefore by no means the same throughout, or *semper eadem* as the Church of Rome calls itself, but by its very nature it is a product of growth and a thing that changes, — an expression of human knowledge, which proceeds and progresses with that knowledge itself. What we call "moral feeling" has its origin in the social instincts or habits which each human (or animal) society develops, and must develop within itself, if it is not to perish by its own incapacity. Morality, therefore, is evolved from sociability, or the faculty for living in a community, and it changes according as the particular ideas or necessities of any given society change. Thus, the nomadic savage thinks it is a very praiseworthy action to kill his father when effete with age, whereas in the eyes of the cultured European parricide is the most horrible of all crimes.

Now seeing that man is essentially a social being,

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and can, without society, either not exist at all or only be thought as a predatory animal, it becomes easy to understand that his living in social communion with others must have saddled him with duties of reciprocity which in course of time developed into definite moral axioms. The beginnings of this are to be found in family life, which in the sequel developed into tribal and national life. Morality is, therefore, much older than religion, the latter being only a requirement of the individual, while the former is a requirement of society and had its germ in the earliest beginnings of social co-existence. Thus, it stands to reason that morality cannot have originated in religion, but is entirely independent of it. It was not until a comparatively recent period of civilisation that the two became connected with each other, and by no means to the advantage of the former. For it may be averred without fear of contradiction that religion is injurious to morality, in so far as it assigns to it an aim based upon egotism and self-seeking, whereas pure morality finds, and ought to find, its reward in itself, so that it may subserve the objects of Society at large and be at the same time a blessing to the individual, as a member thereof. The original object of religious institutions was not, as has been admirably shewn by *E. Bournouf* in the history of creeds, to make moral or virtuous men, but merely to afford a simple corroboration of the metaphysical or supernatural theories invented by the ancestors. Many ages had elapsed before the different churches laid down definite rules of conduct for their members. In keeping with this, the ethnological researches of *E. B. Tylor* have shewn that the moral

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ideas of savages never and nowhere originate in religion, and that among them the touch existing between religion and morality is, as a rule, but very slight and only of secondary importance. Wherever morality and religion have existed, each has held originally its own independent ground; and the inculcation of duties towards one's neighbour occupies in the history of creeds a very much later stage than the regard for the wishes or commands of a deity. According to Tylor, recognised customs and rules respecting the relation between man and man, being the systematic result of social forces, represented the earliest beginnings of an independent morality, and only at a higher stage of civilisation did the influence of religion on morals become possible and perceptible.

From all this it appears very plainly that customs, and not religion, first created morality. It would appear, indeed, that the former have of all times rather impeded than promoted the latter, and that customs become the more firmly rooted and the more powerful, the more religion is cast into the background and the less the individual can hope to be relieved of his sins by propitiating the church and its ministers. Besides, religion counteracts morality and universal philanthropy in so far as it sets men against each other by the diversity of doctrines and theories of belief, thus fostering and nourishing the worst impulses of human nature. Lastly, it must not be forgotten that the moral precepts laid down by religion are mostly antagonistic to human nature and therefore wholly impracticable.

It is obvious, as Père *Meslier* has shewn with great plausibility and acumen, that a strict observance

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of the moral precepts taught by any, say for instance by the Christian, religion, must involve the ruin of nations and destroy all the bonds of society, since we are told that every pursuit of earthly objects is incompatible with a Christian's care for the salvation of his soul. Besides, as a matter of fact, no one ever takes these precepts *au sérieux*. "It is not an easy thing to find a courtier who dreads the anger of God more than he does his master's displeasure. A pension, a title, a ribbon, are sufficient to cause the pains of hell and the joys of the heavenly court to be forgotten. The caresses of a woman outweigh in every age the comminations of the Lord. A joke, a scoff, a *bon mot*, make a deeper impression on a man of the world, than all the most serious conceptions of his religion."

It is plain, therefore, that the fountain-head of all good actions is not to be sought in the belief in God or in mortality or in whatever is connected with them, but in the conviction that it is the duty of the individual to act in the manner which is recognised and defined as good or useful by Society, that is to say by the joint union of all for mutual welfare. Furthermore, the individual does the right thing out of regard for his own good, his own advantage, his own fair fame, and his social position, or having the fear of the law and of punishment before his eyes. The better ordained and regulated the social order in which the individual lives, the keener will be his own desire to lead a virtuous and moral life. To this may be added the moral instinct or the spontaneous disposition towards a moral behaviour, a sort of moral organisation which each individual receives from those

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parents and ancestors who have lived for long ages in more or less orderly social or political conditions. If to all this be added the powerful influence of education, habit and example, we are in possession of all that is necessary for moral behaviour, without being obliged to have recourse either to an innate moral law or to the means of grace or the hope of glory held out by the church or religion. This being so, what is the good of those everlasting hypocritical confessions of faith and professions of religious dogmas, which are opposed to reason, and neither required by, nor conducive to, virtue and morality? It is not the fear of God that has a moralising effect, as is most clearly shewn by that period, replete with the fear of God on the one hand and of moral horrors of every kind on the other, which we call the middle ages; on the contrary, moralisation must be looked for in the general refinement of customs and of social habits and of views of life in general. For this reason we must, at the present time, look for a basis of morality very different from the fantastical and unpractical, out-of-the-way belief in things supernatural and independent of Nature. Science must take the place of religion; and belief in a natural and infrangible universal order must be substituted for a belief in spirits and ghosts, and the factitious morals of dogmas make room for a morality suited to Nature.

As regards this morality suited to Nature, it must be clear from what has already been said that it can only be based permanently and durably on that principle which gave it birth, viz. the principle of *reciprocity*. There is therefore no better standard for moral conduct than the old rule laid down by *Confucius:*

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"Don't do to others what you would not have others do to you." If this negative rule be supplemented by the positive one, "Do to others as you would that they should do to you," we get a whole code of natural morals and ethics in hand which is certainly better and simpler than can be found in the bulkiest treatises of morality or in the quintessence of all the religious systems of the world. All further moral directions which may be drawn from conscience, from religion, or from philosophy, are entirely superseded by these simple and practical rules; all fears of the contrary become groundless. Of course these rules must become the more efficient the more highly the feeling of reciprocity is developed by the cultivation of social conditions and of the sense of right, and the more the individual is enabled by natural talent, education, example and habit, to contribute to the objects of society and perform his duties towards his fellow-men. It is therefore a fact recognised everywhere and demonstrated by history, that the moral idea is developed and becomes more powerful in every respect in proportion as the social organism progresses; and accordingly enhanced public order goes *hand in hand* with a proportionate alleviation and toning-down of the harshness of the criminal code. For since the institutions of the State and of Society compel the control of the crude passions and impulses inherited from the condition of the brute, the individual is rendered by inheritance and habit ever more capable of living according to the rules of moral behaviour laid down for him by custom and habit.

While in the state of isolation or savagery, man possesses no other moral impulses but those inherited

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from animal sociability and as a rule follows blindly, like the animal itself, the promptings of hunger, passion, cruelty, self-interest, and so on; his moral faculties first develop by his being brought into communication with others, within a society ruled by certain principles of reciprocity, and by the recognition of laws which are necessary for the existence of such a society. Hence, as we have shewn in a previous chapter — the conceptions of *good* and *evil* have nothing absolute about them; they shew on the contrary the most marked differences, according to the diversity of time, place, nation, race, stages of civilisation, climate, and so on. After all, as *Hamlet* says, nothing is in itself good or evil, "thinking makes it so"; that is to say, the consciousness that the individual has of himself and his behaviour, according to his idiosyncrasy which is ruled by internal and external conditions.

Morality may therefore be defined as the law of an equal mutual respect for general as well as private human rights, which law itself has for its object to provide the largest amount of human happiness. Whatever disturbs or undermines this happiness and this respect is *evil*: whatever promotes them is *good*. Evil, according to this definition, is confined to the degeneracy or the excesses of private human egotism or self-will, detracting from or overriding this universal happiness, as well as the interests of the fellowman. A human society attains the higher a grade of morality, the more it succeeds in reconciling the egotistic or self-willed tendency of human nature with the interests of the common weal or the collective will. The greatest sinners, therefore, are the egotists, that is to say those who place their own *ego* above

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the interests and laws of the common weal, and who endeavour to unduly satisfy this *ego* at the expense and to the detriment of those whose rights are equal with their own. Of course there is nothing essentially wrong in egotism or self-love or in the care for personal welfare, which, being properly directed, may act most beneficially for the individual and for the community at large. For, after all, self-love is the last and most powerful motive of all our actions, even of the good ones, for most good actions arise from compassion which is a refined description of self-love*), and our general moral conduct is determined by considerations of individual welfare and has individual advancement for its goal. It will, in point of fact, never be possible to completely eliminate or suppress the egotism of human nature; therefore, the one thing needful is to lead it into the right path and render it rational and human, by seeking to bring its satisfaction into unison with the good of the individuals and with the interests of the community. Society must be so organised that the welfare of one shall no longer be conducive to the detriment of others, as is now but too often the case; every one ought to find his own interest indissolubly connected with that of all, and on the other hand the welfare of the community should be like a mathematical function of the welfare of the individual. As soon as we have reached this goal the attainment of which is by no means so difficult as it is usually represented to be, every conflict between the interests of the individual and of Society, that had previously sprung from motives of

*) See note 104 in the Author's work on Man.

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self-interest, must needs come to an end, and the chief sources of crime, sin, vice, and wickedness must be stopped up at the same time. The individual will then find it much easier than at present to seek personal happiness and pleasant emotions, or in other words to satisfy his *ego* without injuring the interests of the community. He will only promote his own welfare by advancing that of all, and the general interest will be subserved by the fact of his own not being disregarded.

In this reconciliation of the interests of individuals with those of all others, that is to say, of Society, we behold the great moral principle of the future. If we succeed in bringing about such a conciliation, we shall have no lack of morality, virtue and generous impulses. If we do not succeed, we shall be deficient in them in the precise proportion in which the distance performed falls short of this goal; and no impact brought to bear upon us from within or from without, no conscience, no religion, no moral preaching, and no penal enactment, will be able to supply that want. The public conscience is also the conscience of the individual, and that public conscience can only be the result of wise political and social conditions, satisfying the want of man, and of a system of education and training of all founded on the principles of universal philanthropy. The age best fitted for the formation of that conscience, and consequently of all morality, is youth, which is so well adapted for education and training and so easily influenced by impressions from within and from without. The chief task of public and general education must therefore be to awake and strengthen in

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the youthful mind the tendencies and dispositions which are good and useful to human society, and to counteract and suppress those which are injurious and deleterious. In this way a new race will gradually be evolved, whose faculties and organization will be of a higher type; and in proportion as such a new race grows up, crimes, sin, vice and every evil disposition will disappear in the ratio in which the only ground suitable for them grows narrower and is rendered more barren.

If, despite of all this, men are still to be found who behold a danger to morality and propriety, and thence to the State and to Society, in the sacrifice of religious or metaphysical dogmas and in the diffusion of a belief in the existence of a natural order of the world, directed neither from above nor from without, we can only look down with compassion on such ignorance and obtuseness. Man can only be a gainer and not a loser both intellectually and morally by the spread of knowledge and education and by the disappearance of superstitious ideas. To refuse to recognise this is to run counter to all reason and all history. Popular theories about the government of the world and immortality may change or take whatever forms they like; human Society will not be changed for all that, and will not come to grief.

But if our view should not be wholly accurate, and if in reality it should not be possible for the human race to extricate itself from the errors and prejudices of centuries without thereby coming to grief, then all that science, and the philosophy of nature or cosmogony that is built upon it, can say is that Truth (as we stated at the beginning of this chapter) towers high above all things divine and

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human, and that there can be no arguments strong enough for dispensing with it. "Truth," said the great *Voltaire*, "has inalienable rights. Just as it is never out of season to search for it, so it can never be out of season to defend it."*)

*) See the Author's views on morality and religion on pp. 236 *et seq.* of his work on "Man." On the future organisation of Society in the sense suggested above see pp. 190 *et seq.* of the same work.

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CONCLUDING OBSERVATIONS.

> Men will always deceive themselves, while they abandon experience for systems hatched up by superstition. Man is the work of Nature, he exists in Nature, he is subject to its laws, he cannot free himself, he can never even rid himself of them in thought; vainly does his spirit seek to penetrate beyond the boundaries of the visible world; he must ever return to it.
>
> Système de la Nature.

"It is now nearly twenty years," said *Goethe* in his posthumous writings, "since all the Germans became Transcendentalists. On the day when they become aware of it, they will certainly appear very strange in their own eyes." This prophecy has been fulfilled; and more rapidly than could have been expected from the slow progress of human knowledge, the systems of ideal-philosophy of the post-Kantian period, which had been ushered in with such flourishes of trumpets, have outlived themselves or have fallen into oblivion. No one now speaks about them, and the philosophical characteristic of the age consists in the whole host fleeing in wild confusion and seeking a refuge behind the safe walls of the old Kantian theory of knowledge, or rather non-knowledge.

If we look for the reasons that have brought about this remarkable phenomenon — doubly remarkable in a country like Germany — we find that one

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of the most powerful agencies of this great change lies in the gigantic strides that natural science has taken within the last half century, not only in connection with material but also with intellectual life. New regions have been opened up and new points of vision been given to thought, not only by the vast discoveries and inventions made, but also by the mode and method of investigation brought to bear upon them. Thought has thus been compelled to quit the misty and barren regions of speculative *rêverie* for life and reality, or, in other words, to adopt a philosophy of facts instead of a philosophy of words.

"If philosophy," says *Virchow*, "aspires to being the science of the real, it must walk on the path of natural science only, and seek in experience the objects of its study and knowledge. It will then become the science of Nature, not only in essence but also in method, so as to become distinguishable from it in nought but its aim; inasmuch as nearly all philosophical schools have a transcendental object, viz. the investigation of the design of the universe or the fathoming of the absolute, whereas true natural investigation pursues concrete objects and regards the knowledge of the *character of the individual* as its leading task. For it has learned by the example of the past how fruitless was the premature striving after things universal, and *how hopeless is the striving after the absolute.*"

From what has been said, every one may answer the question whether natural science has the much contested right of taking part in the solution of philosophical problems. From all quarters of the province of letters we now hear the cry of the so-called *limits*

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of natural science, and are told that science as such ought only to attend to the sensual, tangible world, and has no business to dabble with the metaphysical or super-sensual world of theologians and philosophers, wherefore all attacks on theological or philosophical dogmas are *in limine* inadmissible. Those who utter these cries are only repeating the dualistic view of nature and of the universe that is based on a forcible separation of the conceptions of force and matter, of God and the world, and of thinking and being, and against which we have been contending on every page of this work. He who is determined, despite all experience, to cling to this view, can no doubt easily overstep the boundaries referred to and allow his imagination to invade regions which either do not exist or else are inaccesible to our intellect. He can fill up all the gaps in the universe or in our knowledge with gods and spirits, demons and devils; he can imagine a heaven and a hell; he can get millions of angels to dance on the point of a needle; he can invent a spiritual matter and let it fly on waves of ether from star to star; he can believe in the existence of beings with four dimensions, in speaking tables, in every kind of spirits and in the haunting of ghosts. For behind that which is closed against the perceptions of our senses or our means of knowledge, any conceivable thing *may* exist for those who do not shrink from the transcendental, or who prefer faith to knowledge. But they can only perform these feats in thought, in fancy, and in that which is transcendental, that is to say, above nature, not in that which is immanent or inherent in her. He who rejects empiricism, that is to say experimental thought, rejects

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all human comprehension and fails to see that human knowledge and thought, without real results drawn from experience, must be looked upon as a *non ens*, or nonsense. *Thinking* and *Being* are as inseparable, as force and matter, or spirit and body, and the idea of thought *without* being, or of an immaterial spirit, rests on a mere arbitrary theory which has not an inch of reality to stand on; it is a hypothesis floating in the air. Were the human mind endowed with metaphysical knowledge, independent of the real world, then we should be justified in expecting from metaphysicians the same conformity and certainty of views as exist among natural philosophers on the law of gravitation, or among physiologists on the function of a muscle. Instead of this we find among them nothing but doubts, and contradictions, and theories of the most widely divergent and often diametrically opposite natures. One says this, another says that; each calls his opponent an ass, and if barefaced assertions were proofs, we should be compelled to accept the most contradictory and preposterous statements as demonstrated.

"Every one can see," forcibly remarks *Vignoli* (Die Intelligenz im Thierreich, p. 25), "how far philosophy has attained to certainty up to the present time with regard to its ontological speculations. System destroy system, one theory contradicts another, and doubt, possibility, and at most probability rule the roost; there are as many philosophies as there are speculative heads!"

The audacity of philosophers in metaphysical matters contrasts most strikingly with their affected modesty and reticence in empirical matters or in any

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explanation of existence based on scientifically proven facts. Those who were in the habit of taking the most extravagant flights of imagination in a super-sensual world, suddenly turn to worms creeping in the dust, whose spheres of sight and knowledge cannot reach beyond their most immediate surroundings, and are not even sure that what is represented to them by their limited sensual world is certain or real. Hence, what man understands, is confined within the subjective perceptions of the senses or an appearance behind which the ever hidden nature of things, the famous "thing in itself" remains unknown and can never be solved; the old Socratic axiom is once more adhered to, that the last word of wisdom is to know that we know nothing.

This pride of the "know-nothings" is as unjustified and unwarranted as the pride of the "omniscients." It takes all inward delight in scientific search away from thinking men. Who has ever doubted that human knowledge is limited by certain insurmountable barriers? But does it follow from this that we must leave off carrying on any search into existence by the aid of our senses? — for other means we have none. Empiricism or experimental philosophy has, as *Lefèvre* remarks, as good a right as Idealism to appeal to the famous axiom of *Protagoras,* that man is the measure of all things; but the experimentalist remains more faithful to this axiom than his opponent, since he does not go beyond this measure, and attends neither to "things in themselves," nor to the "absolute," any more than to the ever insoluble question of the Why? He confines himself to the question of the How? or Whereby? and collating

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the results of experience and observation he limits himself to derive the necessary universal conclusions therefrom, while the metaphysician attends to hypotheses and theories of existence, which are incapable of proof by experience.

In this sense and from this point of view ought be judged the attempt at narrowing the province of natural science spoken of at the beginning of this chapter. Those who would make such a limitation are either ignorant of the utter inadmissibility of such a claim, or they follow an impulse of instinctive dread lest those sciences might effect a ruthless destruction of certain opinions that had hitherto been clung to; it is even possible that they deliberately place science *beneath* faith. According to our views no philosophy that lays claim to being true or clear can exist without those sciences; they are the essential and bitter foe of ignorance, fanatism and inanity of thought. Any discussion of philosophical problems which cannot be brought into unison with the results obtained by science, is worthless and senseless. All human knowledge, in whatever direction it may tend, is so necessarily and indissolubly interwoven with science, that it is *prima facie* impossible thus to break off a single branch from the general trunk; and according to the views of distinguished authors all philosophy has its basis in the consciousness which empirical science gradually acquires of itself.

The boundaries which individual naturalists of note have lately thought themselves obliged to draw around science, are equally inadmissible. Science knows of no limits save those which lie in its own subject, and there can be nothing more foolish, than

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to try and set *ab initio* permanent insuperable bounds to human investigation — provided it does not stray into the province of transcendentalism. For he who tries to do this can never pass beyond the limits of his own age and knowledge, and must possess the supernatural gifts of a prophet or seer, in order to be able thus to lay down the law of the progress of knowledge in days yet to come. If a thousand years ago a *savant* had maintained that it would never be possible to fathom the nature of the sea-serpent or of demons, or to discover anything definite about the philosopher's stone, or perpetual motion, or the nature and movements of the stars, or the creation of the earth, or the descent of men and of the organised world, there would have been just as much sense in this as in the talk about the insolubility of many "problems of the universe" with which some people try to give themselves airs at the present day. Only as far as the final cause of things, the ultimate Why? is concerned, can such a position, as stated heretofore, be upheld; but it never can in regard to our investigations on the intrinsic connection of things, in accordance with the infrangible law of cause and effect, the How? and the Whereby? The only actual limit to our knowledge, as *Virchow* forcibly observes, is *ignorance;* and *Wieland* lays down the rule that whatever we *can* know we *may* know. The enthusiasts or fanatics of know-nothingism are in their way as intolerant as those of faith, and are the more dangerous in that they know how to spread around them the deceptive veil of objectivity, whilst in reality their pretension at trimming is merely based upon a contemptible fear of being taxed with atheism

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and upon want of the moral courage required for consistent thought. If in the matter of religion and of all that goes beyond our sensative knowledge, nothing remains to us but to kneel submissively before the shadow cast by our own ignorance, we must, as an English writer remarks, despair of knowledge and deem the dead happier than the living. But in reality, if we look at things in open daylight, we find that the "Unknowable" of modern Agnostics is nothing more than the good old God of the theologians, who has already made his appearance in so many deceptive disguises in the history of philosophy. It makes no essential difference whether he answers to the name of "Will," or "Unknown," or "Thing *per se*," or "Universal Soul," or "Universal Reason," or "Unknowable"; at the bottom of it we always find the same anthropomorphic disfigurement, the same *asylum ignorantiæ* and the same vague being which, being begotten of the fear of the unknown, ruled of yore over the crude primeval man and will continue to rule over the civilized man, until the sun of knowledge and the recognition of a natural and self-contained order of the world shall have made a reality of the *Fiat lux!**)

*) See Appendix C.

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APPENDIX.

A. This remarkable atheistic and materialistic religion was founded on a purely natural basis 600 B. C. by an Indian prince named *Gautama* or Buddha (the Enlightener, the Wise) or *Sakjamuni* (hermit of the tribe of Sakja). Rejecting the hateful system of castes, he taught the equality and brotherhood of all men; he abolished sacrifices; he denied the existence of God and of an innate conscience, and sought all his principles in *man only* and in the love of one's neighbour. This religion so thoroughly possessed the faculty of speaking to the minds and winning the hearts of the people that in a comparatively short time it spread over nearly a third of the then existing human race, without wading, like Christianity, through an ocean of blood and atrocities. In the year 800 after Christ it was again uprooted in India by the reaction of the priests and Brahmins, who had waged most bloody religious wars upon it. It was then diffused all the more rapidly and effectually over the neighbouring countries, and at this day it is the most widely disseminated religious system of the East, mustering a great many more adherents than Christianity. The cosmology of Buddha, like modern science, teaches as the beginning of things the existence of infinite and infinitely rare matter, out of which the individual worlds originated gradually by condensation. These, however, were again volatilized, and again new forms arose, and so forth. The government of the universe consists in an irrefragable necessity, flowing from the supreme law of cause and effect. The worlds follow one after another in gradation and become more and more perfect; the same holds good for organised beings, until at last all returns to the original state of absolute rest and redemption, the so-called Nirvana or nothingness. Buddha held with the most complete

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freedom and toleration towards other opinions, which he regarded only as lower stages of knowledge. In order to prepare worthily for his great mission he spent, not 40 days like Christ, but several years in the wilderness and in solitude, where he, according to the Buddhist legend, was like Christ tempted in vain of the devil. The same legend relates that, like the founder of Christianity, he was born by supernatural means of Maya, a king's daughter, rendered pregnant by a ray of sunshine. With a view of destroying the misery of the whole world, the Buddhists also sent out missionaries like Christians, and like them held councils or assemblies of the Church. Their object was the good of mankind, in opposition to Brahminism, which aimed at nought but personal advancement. The zenith of Buddhism was attained under the two kings *Asoka*, the first of whom raised Buddhism to a State religion in 250 B. C., without however persecuting any other creeds. Under their rule Brahmins and Buddhists lived peacefully side by side. Fifty years after Christ King *Kanischka* called the fourth Council together. *Max Müller* describes the Buddhist moral code as one of the most perfect the world has ever seen, although Buddha not only rejected the theory of souls, but regarded it as injurious and as tending to superstition. In the place of theological legends and tales, the great sage taught wisdom, benevolence and the comfort of final rest; it was he — not Christ — who first raised universal love for man to the rank of the highest virtue. The traditions which surround the life of Buddha bear the most striking resemblance to the Christian. (Compare the *National Reformer*, 1882, vol. XXXIX, Nr. 20.) Unfortunately Buddhism (like Christianity) degenerated later on in various directions in those countries over which it ruled and became imbued with all imaginable follies and insane fancies, while its chief principle, the Nirvana, was changed into a paradise full of miracles and saints. For while the Buddhist philosophers and thinkers logically developed the doctrine of the founder into ever clearer Atheism, it was turned by the uneducated people into partly monotheistic, partly polytheistic systems, and mixing with Brahministic elements it departed from its original purity; on the other hand, Brahminism also embodied within itself a number of Buddhistic elements. *Christian* ideas and institutions also became mingled with it (especially in Thibet), as Nestorian Christianity invaded Central Asia, and it was chiefly owing to them that the

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Thibetan church has now, like Catholicism, its pope and cardinals, its bishops, priests and nuns, its masses for the dead, its paternosters and rosaries, its holy candles and holy water, its processions, feast-days and fast-days, etc., and that divine honour is paid to the Dalai-Llama, or high-priest of Thibet, the earthly representative of the now deified Buddha. (See further details in *Radenhausen's* "Christenthum ist Heidenthum," Hamburg 1881, p. 60). Despite all this, the principles of Buddhism remain so powerful in some of its adherents, that according to Dr. *J. W. Helfer's* report of the provinces of Tenasserim, the *Buddhists* do not, like the adherents of other religions, seek for converts, and shew themselves equally tolerant of all creeds. They do not assert that their religion is the best or the only true one, but only that it is the most suitable to themselves. Nor do they hesitate to adopt certain features of other religions which seem good to them. It is easy to understand that the Buddhists oppose an energetic resistance to the attempts at conversion made by Christian missionaries. When English parsons tell them that they should adopt the religion of love to man and to enemies as their own, they very properly reply: "What? we are to forgive enemies who invade our country? You never forgive your enemies. While you preach peace, you are blowing trumpets of war. Your peaceable voice is the voice of powder and shot. You preach self-denial, but your priests live in wealth and luxury. In your worship of God you light candles, as though God dwelt in darkness. Go home and teach your own people to be peaceable, honorable and temperate." Some Brahmins, strongly objecting to the fanatic religious and proselytizing zeal of Christianity, said to Dr. *Haug*, professor of Sanscrit in the British college of Puma (Bombay Presidency): "This fanaticism is a clear sign of mental weakness and narrowness. A wise man persecutes no one on account of his religious views." Further details on Buddhism and its teachings will be found in the Author's Lectures on the Darwinian theory, at the beginning of the fifth Lecture.

B. In the year 1828 Wöhler, in artificially making *urea*, a pre-eminently organic substance, from ammonium cyanate, destroyed the theory that organic compounds could only be produced by organised bodies. In 1856 Berthelot performed the synthesis of formic acid from inorganic materials, that is to say from carbon

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oxide and water, heated with caustic potash, without the co-operation of either plant or animal. Soon afterwards, the synthesis of *alcohol*, or spirit of wine, was successfully accomplished directly from its elements, carbon, hydrogen and oxygen. With the help of alcohol thus obtained, a whole series of other organic bodies and a number of new compounds were produced, such as the various kinds of ether, many vegetable oils and perfumes, many organic acids, such as racemic, lactic, acetic, oxalic acid, and so on. Even fat can now be artificially made from fatty acids and glycerine, both of which can be formed by purely chemical means; and it is hoped that ere long it will have become possible to perform the synthesis of sugar and albumen, that is to say of absolutely organic articles of nourishment. "We may hope," says Berthelot at the end of his admirable work on chemical synthesis (Leipzig, 1877), "to form anew all substances which have been developed since the beginning of things, and to do this under the same conditions and the same laws and by the aid of the same forces, which Nature has used in their formation." The method employed by Berthelot to bring about his remarkable results (sealing up inorganic substances hermetically in glass globes, and subjecting them for months to a high temperature) strikingly recalls the chemical and physical conditions of what used to be the primal ocean, at the bottom of which must have appeared the earliest organic compounds. — Compare on this question the essay: "Künstliche Darstellung der organischen Verbindungen aus ihren Elementen," in "Unsere Tage, (Braunschweig, Westermann), part 78, 1865, p. 779.

C. In the earlier editions of this work the place of this concluding remarks was occupied by a polemical dissertation directed against an attack on the theory of the world herein explained, which attack having been published by a distinguished naturalist, a short time prior to the appearance of the first edition of the work, had much attracted the attention of the educated world and called forth many replies. This dissertation in question ran as follows: "Every one who knows the circumstances of the case, must regret that a man to whom exact science is so much indebted should, under the instigation of morbid sensitiveness, have thought proper to publicly throw down the gauntlet, to the mechanical and material theory of nature, without any provocation

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whatsoever. No doubt it was done after such a method as is usually followed by the courage of despair; for being fully qualified by positive knowledge to perceive the impotent nature of idealism, he himself began with the confession, that all resistance would be useless in the face of the ever more closely approaching and more threatening foe. But he did not attempt to contend against his invisible and yet so much dreated foe with facts — for he could not but be aware that no facts were at the command of idealism — but by a device which in ordinary life is usually called a "false charge"; he tried *to impugn natural truths with moral consequences,* a device which must be set down as so utterly unscientific that it is hard to understand how any one could venture to bring it forward before a meeting of men possessed of scientific training. To be sure, its inventor at once received his reward, for the disapproval of the meeting was clearly betokened after the lecture had been delivered. "The doctrine," exclaimed Professor *Rudolf Wagner*, at the last meeting of German naturalist and physicians held at *Göttingen*, "which follows from the materialistic theory of the universe is: Let us eat and drink, for to-morrow we shall be dead. All great and earnest thoughts are idle dreams, phantasms, games of mechanical contrivances running about on two legs and with two arms, which are dissolved into chemical atoms, and get joined together again, ... like the dance of madmen in a lunatic asylum, without a future, without a moral basis . . . . . The idea which lies at the root of this outburst of wrath, so thoroughly coincides with the views which we have had occasion to controvert in the preceding chapter, that we may well spare ourselves the trouble of again criticising this false and unfairly charge. To decide that a principle is untrue, because of the consequences which foolish people may eventually think themselves entitled to deduce from it, although in itself it is proven and accurate, is certainly both a perverse and a mischievous strategem. "If Herr Wagner," says *Reclam* (Deutsches Museum), "is going to accept this principle as a general rule, then the use of matches should be probibited, because they may give rise to a conflagration; warrants of apprehension must be issued against locomotives, because people have before this been run over by them; houses should have no upper stories, for fear of people falling out of the windows."

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But the idea that all great and earnest thoughts will become empty dreams because of the adoption of a natural theory of the universe, and that on that account the future and the basis of morality will perish, is so utterly arbitrary and rash that it has no claim to serious refutation. In all ages great philosophers have held such or similar views and yet have not become fools, or robbers, or murderers, or desperadoes. At the present day, our most earnest workers and most indefatigable students of the province of natural science hold the same views, but no one has ever heard that they have verified Dr. Wagner's apprehensions. The striving after knowledge and truth and the conviction of the necessity of social and moral order are for them an efficient substitute for all that is meant by religion and the future in the popular belief. And if such knowledge, having become general, should involve an increase of that striving after transitory pleasure which has always been, and still is, sufficiently prominent in man, we must comfort ourselves with the words of *Moleschott:* "The erroneous theory of seeking after pleasure will scarcely find half as many disciples, as the rule of priests of all shades has claimed unfortunate victims."*) As a last resort we have the right to cast aside all such questions of morality or utility. The highest and sole ground we stand on in our researches is *truth.* Nature exists for her own sake, not for the sake of religion, of morality, or of man. What can we do except take her as she is? Should we not lay ourselves open to just derision, if we were to shed tears like children, because our bread is not buttered enough! "Empirical investigation of nature," says *Cotta,* "has no other aim but that of discovering truth, whether it appear to human thought re-assuring or alarming, beautiful or ugly, logical or inconsistent, wise or foolish, necessary or miraculous."

Could a man of sense *really* wish to forbid the progress of natural science and seek to debar it from taking its due share in the solution of philosophical problems, on no other ground but that the final results of such investigations are not agreeable to

*) As far as the enjoyment of life is concerned, we only differ from the *ancient world*, which managed very felicitously to bring its principles and its actions into harmonious concord, in so far as we have within ourselves a contradiction between our actions and our philosophical theory of the world. "The hypocrisy of self-deception," says *Ludwig Feuerbach*, "is the besetting sin of the present day." Taken from the II—IV Edition.

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himself and to others? That truth is not always pleasant, not always comforting, not always religious, not always attractive — all this is as well known as is the old experience of the almost entire want of external or internal reward that she bestows on her followers. At least, this reward stands in no proportion to the difficulties which have to be surmounted on the road. *Externally* it has ever consisted of personal danger and persecution, wherever truth has come into contact with old-world opinions; how uncertain its *internal* reward is, has been well expressed by an ingenious Persian in the following words:

"And yet no; cast away the mind, break its fetters!
"Be a fool! for the fool alone is happy.
"Like the nightingale near the rose such a heart rejoices eternally,
"For it has escaped thy thorn, the torture of knowledge.
"Therefore, blessing his God, let him thank fate
"Who, blessed in error, can still be happy."

To the poet the nature of things appeared in its last simplicity, and unshrouded by the mass of external additions with which the clear voice of truth has been rendered unintelligible by error or calculation to the greater part of mankind: but he could not therefore escape from the mental unrest, the mental pain, which is only conceivable by those who have passed along certain paths of knowledge. He rightly accounts him happy who is "blessed in error," but he is wrong to tell him to thank his God for it. Only the man who possesses knowledge can regard the ignorant as happy in his limitations, because only for him can the pain of knowledge exist, whereas the very essence of error consists above everything else in neither understanding nor conceiving the error. In the deepest consciousness of this curious fact, and perhaps thinking of the soft, dreamy enjoyment of life in the East, the Persian actually claims that such happiness is to be preferred to the restless chase after knowledge. Very differently does the Western world feel and think; life without struggle and activity has no charm for it. Truth hides within herself an intrinsic charm of attraction, by the side of which all other human considerations vanish; and among Western civilised nations there will never be a lack of enthusiastic disciples and followers, regardless of consequences. No prohibition, no external difficulty, can for any length of time, block up the path of truth; it grows stronger

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under the pressure of obstacles. The whole history of the human race, despite the huge mass of follies which crowd upon each other and form, as it were, an unbroken chain, is a continuous proof of this contention. Even while in the hands of the Inquisition, Galilei uttered his famous words, which have been repeated and reverberated a thousand times over:

"E pur si muove!"

"And yet it moves!"

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